

2014-1617, -1619

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**United States Court of Appeals  
for the Federal Circuit**

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LEXMARK INTERNATIONAL, INC.,

*Plaintiff-Cross-Appellant*

v.

IMPRESSION PRODUCTS, INC.,

*Defendant-Appellant*

QUALITY CARTRIDGES, INC., JOHN DOES, 1-20, BLUE TRADING LLC,  
EXPRINT INTERNATIONAL, INC., LD PRODUCTS, INC.,  
PRINTRONIC CORPORATION, TESEN DEVELOPMENT (HONG KONG)  
CO. LTD., and BENIGNO ADEVA AND HIS COMPANIES,

*Defendants.*

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*Appeals from the United States District Court for the Southern District of  
Ohio in Case No. 1:10-CV-00564-MRB, Judge Michael R. Barrett*

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**NON-CONFIDENTIAL JOINT APPENDIX**

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*Lexmark International, Inc. v. Impression Products, Inc.*, Federal Circuit No. 14-1617**ORDERS AND JUDGMENTS**

| <b>Date Filed</b> | <b>Doc. No.</b> | <b>Description</b>  | <b>Apx. No.</b> |
|-------------------|-----------------|---|-----------------|
| 06/24/2014        | 670             | Stipulated Final Judgment   | A0001           |
| 03/27/2014        | 615             | Order granting 395 Motion to Dismiss for Failure to State a Claim as to Defendant Impression Products | A0004           |
| 03/27/2014        | 617             | Order denying 335 Motion to Dismiss for Failure to State a Claim as to Defendant Impression Products  | A0017           |
| 06/24/2014        | 668             | Stipulated Permanent Injunction as to Impression Products, Inc.                                       | A0029           |
| 06/24/2014        | 669             | ORDER granting 661 SEALED MOTION filed by Impression Products, Inc., Lexmark International, Inc.      | A0034           |

**DOCKET SHEET**

| <b>Description</b> | <b>Apx. No.</b> |
|--------------------|-----------------|
| Docket Sheet       | A0036           |

**DOCKET ENTRIES**

| <b>Date Filed</b> | <b>Doc. No.</b> | <b>Description</b>  | <b>Apx. No.</b> |
|-------------------|-----------------|---|-----------------|
| 08/20/2010        | 1               | Excerpt of Complaint for Patent Infringement  | A0106           |
| 12/09/2010        | 85              | Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice as to Virtual Imaging Products, Inc.  | A0128           |
| 06/28/2012        | 126             | Excerpt of Lexmark International, Inc.'s Motion for IJSS to be Held in Contempt for Violation of This Court's Permanent Injunction Order<br><br>Exhibit 20 to the Declaration of Dr. Charles F. Reinholtz | A0696           |
| 04/22/2013        | 233             | Excerpt of First Amended Complaint for Patent Infringement  | A1777           |

| <b>Date Filed</b> | <b>Doc. No.</b> | <b>Description</b>   | <b>Apx. No.</b> |
|-------------------|-----------------|--|-----------------|
| 06/17/2013        | 279             | Minute Entry for Proceedings Held Before Judge Michael R. Barrett on Lexmark International Inc.'s Motion for Contempt  | A1808           |
| 07/30/2013        | 335             | Excerpt of Impression Products, Inc.'s First Motion to Dismiss   | A1819           |
| 09/16/2013        | 395             | Excerpt of Impression Products, Inc.'s Second Motion to Dismiss  | A1837           |
| 10/11/2013        | 434             | Excerpt of Impression Products, Inc.'s Reply to Plaintiff Lexmark International, Inc.'s Response in Opposition to Its Second Motion to Dismiss   | A1856           |
| 10/22/2013        | 450             | Excerpt of Impression Products, Inc.'s Response to Plaintiff Lexmark International, Inc.'s Motion for Leave to File a Sur-Reply in Opposition to Defendant Impression Products, Inc.'s Second Motion to Dismiss  | A1875           |
| 11/01/2013        | 463             | Excerpt of Second Amended Complaint for Patent Infringement  | A1891           |
| 05/29/2014        | 661             | <b>CONFIDENTIAL</b> Joint Motion for Entry of Stipulated Order Regarding Supplementation of Record, Limited Reconsideration to the Extent Necessary to Preserve Appellate Rights, for Non-Infringement With Respect to Toner Cartridges First Sold Inside the United states, for Infringement for Toner Cartridges First Sold Outside the United States, and for Entry of Final Judgment | A2553           |
| 06/27/2014        | 671             | Impression Products, Inc.'s Notice of Appeal   | A3918           |
| 06/27/2014        | 672             | Lexmark International Inc.'s Notice of Appeal  | A3925           |

### TRANSCRIPT

| <b>Date</b> | <b>Description</b>  | <b>Apx. No.</b> |
|-------------|---|-----------------|
| 06/17/2013  | Excerpt of Transcript of Proceedings Before the Honorable Michael R. Barrett on Plaintiff Lexmark International, Inc.'s Motion for Contempt | A3928           |



**PATENTS-IN-SUIT**

| <b>U.S. Patent No.</b> | <b>Title</b>  | <b>Apx. No.</b> |
|------------------------|---|-----------------|
| 5,337,032              | Reduced Component Toner Cartridge   | A4023           |
| 5,634,169              | Multiple Function Encoder Wheel For Cartridges Utilized In An Electrophotographic Output Device | A4028           |
| 5,758,231              | Venting Plug In Toner Cartridge   | A4050           |
| 5,758,233              | Toner Cartridge With Locating [Surfaces] On Photoconductor Shaft                                | A4084           |
| 5,768,661              | Toner Cartridge With External Planar Installation Guides  | A4118           |
| 5,802,432              | Toner Cartridge with Housing and Pin Construction   | A4152           |
| 5,875,378              | Toner Cartridge With Hopper Exit Agitator   | A4186           |
| 5,995,772              | Imaging Apparatus Cartridge Including An Encoded Device   | A4220           |
| 6,009,291              | Control Of Photosensitive Roller Movement   | A4251           |
| 6,078,771              | Low Friction Doctor Blade   | A4272           |
| 6,397,015              | Encoded Device Having Positioned Indicia For Use With A Toner Cartridge                         | A4285           |
| 6,459,876              | Toner Cartridge   | A4317           |
| 6,487,383              | Dynamic End-Seal For Toner Development Unit   | A4342           |
| 6,496,662              | Optical Toner Low Sensor  | A4357           |
| 6,678,489              | Two Part Cartridges With Force Biasing By Printer   | A4365           |
| 6,816,692              | Support Assembly For Roller Including Roller Body And Support Shaft                             | A4379           |
| 6,871,031              | Coupling Mechanism For A Two Piece Printer Cartridge  | A4390           |
| 6,879,792              | Two Part Cartridges With Force Biasing By Printer   | A4411           |
| 7,139,510              | Two Part Cartridges With Force Biasing By Printer   | A4425           |

| <b>U.S. Patent No.</b> | <b>Title</b>                                      | <b>Apx. No.</b> |
|------------------------|---|-----------------|
| 7,233,760              | Method and Device for Doctor Blade Retention      | A4439           |
| 7,305,204              | Two Part Cartridges With Force Biasing By Printer | A4451           |

#### NONPRECEDENTIAL OPINIONS

| <b>Date</b> | <b>Case</b>  | <b>Apx. No.</b> |
|-------------|--|-----------------|
| 05/21/2014  | <i>Robert Bosch LLC v. Trico Products Corporation</i> , No. 12 C 437 (N.D. Ill.)   | A4465           |
| 06/13/2014  | <i>San Disk Corporation v. Round Rock Research LLC</i> , No. C 11-5243 (N.D. Cal.) | A4470           |

#### CONFIDENTIAL MATERIAL OMITTED

Pages A2553-2566 has been redacted from this non-confidential version of the Joint Appendix. The material on those pages was designated by stipulated order as confidential under the protective order dated December 2, 2011.

**UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION**

LEXMARK INTERNATIONAL, INC.

Plaintiff,

v.

INK TECHNOLOGIES PRINTER SUPPLIES, LLC, ET AL.

Defendants.

Civil Action No.  
1:10-CV-564-MRB

**STIPULATED FINAL JUDGMENT**

This matter is before the Court on Plaintiff Lexmark International, Inc.'s ("Lexmark's") and Defendant Impression Products, Inc.'s ("Impression's") Joint Motion For Entry Of Stipulated Order Regarding Supplementation Of Record, Limited Reconsideration To The Extent Necessary To Preserve Appellate Rights, For Non-Infringement With Respect To Toner Cartridges First Sold Inside The United States, For Infringement For Toner Cartridges First Sold Outside The United States, And For Entry Of Final Judgment ("Joint Motion"), and the Court having considered the Joint Motion and being otherwise sufficiently advised,

**IT IS HEREBY FOUND, ORDERED, ADJUDGED that:**

1. Judgment is entered in favor of Lexmark and against Impression on Count I of Lexmark's Second Amended Complaint with respect to accused cartridges first sold outside of the United States.

2. Judgment is entered in favor of Impression and against Lexmark on Count I of Lexmark's Second Amended Complaint with respect to accused cartridges that are subject to the Return Program condition (*i.e.*, Return Program Cartridges) and first sold in the United States.

3. This Stipulated Entry of Final Judgment resolves all questions of liability as between Lexmark and Impression and is final, ~~except for an accounting within the meaning of 28 U.S.C. § 1292(c)(2).~~

4. Any claims Lexmark may have against unidentified John Doe Defendants are hereby dismissed without prejudice.

5. Subject to paragraph 3 *supra*, all claims against each of the named Defendants in this action are now resolved.

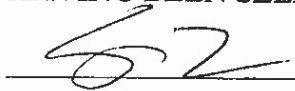
6. This Stipulated Entry of Final Judgment is subject to any appeal that Impression or Lexmark may take based on the Court's Opinions and Orders of March 27, 2014 (ECF Nos. 615, 617), regarding whether Lexmark's United States patent rights are exhausted in (1) accused cartridges first sold outside of the United States and (2) accused cartridges that are subject to the Return Program condition (*i.e.*, Return Program cartridges) and first sold inside the United States.

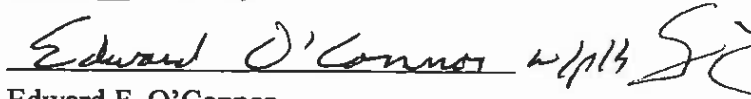
7. Lexmark and Impression make this Stipulated Entry of Final Judgment to promote judicial economy and expressly reserve all of their applicable rights (including all claims and defenses) on remand, if any.

Date: June 23, 2014

s/ Michael R. Barrett  
United States District Judge

HAVING BEEN SEEN AND AGREED TO ON MAY 21 2014, by:

  
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**UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION**

LEXMARK INTERNATIONAL, INC.

Civil Action No.1: 10-CV-564

Plaintiff,

Judge Michael R. Barrett

v.

INK TECHNOLOGIES PRINTER SUPPLIES,  
LLC, ET AL.

Defendants.

**OPINION AND ORDER**

This matter is before the Court on Defendant Impression Products, Inc.'s Second Motion to Dismiss. (Doc. 395). Plaintiff Lexmark International, Inc. has filed a response in opposition (Doc. 431), and Defendant Impression Products, Inc. has filed a reply (Doc. 434). Plaintiff Lexmark International, Inc. also has filed a surreply (Doc. 440-1), and Defendant Impression Products, Inc. has filed a response to the surreply (Doc. 450).<sup>1</sup> This matter is now ripe for review.

**I. BACKGROUND**

This case concerns the alleged infringement of Plaintiff Lexmark International, Inc.'s ("Lexmark") patented toner cartridges. Lexmark contends that the infringement includes cartridges offered under its Return Program, although the allegations in the Second Amended Complaint do not specifically identify the Return Program cartridges as being at issue.

In its opposition brief, Lexmark claims that it offers customers two options when purchasing a cartridge: (1) a cartridge subject to a combination single-use patent and contract license (a "Return Program cartridge," previously referred to as a "Prebate cartridge"), or (2) a

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<sup>1</sup> The Court previously granted the motion for leave to file a surreply, deeming the surreply and the opposition filed. (See Doc. 440-1; Doc. 450).

regular cartridge without any restrictions on its use. According to Lexmark, the purchasers of the Return Program cartridge receive an up-front discount on the purchase price of the cartridge in exchange for agreeing to use the cartridge only once, and to return the empty cartridge to Lexmark for remanufacturing or recycling.

Instead of focusing on the lack of specific allegations in the Second Amended Complaint, Defendant Impression Products, Inc. ("Impression Products") seeks dismissal of the claims on the basis that the Return Program is invalid under patent law.

## **II. LEGAL STANDARD**

In reviewing a motion to dismiss for failure to state a claim, this Court must "construe the complaint in the light most favorable to the plaintiff, accept its allegations as true, and draw all reasonable inferences in favor of the plaintiff." *Bassett v. Nat'l Collegiate Athletic Ass'n*, 528 F.3d 426, 430 (6th Cir. 2008) (quoting *Directv, Inc. v. Treesh*, 487 F.3d 471, 476 (6th Cir. 2007)). "[T]o survive a motion to dismiss[,] a complaint must contain (1) 'enough facts to state a claim to relief that is plausible,' (2) more than 'a formulaic recitation of a cause of action's elements,' and (3) allegations that suggest a 'right to relief above a speculative level.'" *Tackett v. M&G Polymers, USA, LLC*, 561 F.3d 478, 488 (6th Cir. 2009) (quoting *Bell Atlantic Corp. v. Twombly*, 550 U.S. 544, 127 S. Ct. 1955, 1965, 1974, 167 L. Ed. 2d 929 (2007)). A claim has facial plausibility when the pleaded factual content allows the court to draw the reasonable inference that the defendant is liable for the misconduct alleged. *Ashcroft v. Iqbal*, 556 U.S. 662, 663, 129 S. Ct. 1937, 173 L. Ed. 2d 868 (2009). Although the plausibility standard is not equivalent to a "probability requirement," . . . it asks for more than a sheer possibility that a defendant has acted unlawfully." *Id.* at 678 (quoting *Twombly*, 550 U.S. at 556).

## **III. PARTIES' ARGUMENTS**

Impression Products contends that the Return Program is invalid under patent law. In support, it relies upon *Static Control Components, Inc. v. Lexmark International, Inc.*, 615 F. Supp. 2d 575 (E.D. Ky. Mar. 31, 2009) ("*Static Control II*"), where the Eastern District of Kentucky reversed its prior decision, holding that the Supreme Court's decision in *Quanta Computer, Inc. v. LG Electronics, Inc.*, 553 U.S. 617, 128 S. Ct. 2109, 170 L. Ed. 2d 996 (2008), now required it to find that Lexmark's Return Program (then known as the Prebate Program) is invalid. Impression Products contends that the Court should follow that decision.

In response, Lexmark contends that *Static Control II* was erroneously decided because *Quanta*, 553 U.S. 617, did not determine that all post-sale restrictions were invalid. Lexmark contends that its single-use licenses granted to consumers under the Return Program are enforceable, relying on multiple cases including *Mallinckrodt, Inc. v. Medipart, Inc.*, 976 F.2d 700 (Fed. Cir. 1992).

In its reply, Impression Products argues that Lexmark is attempting to enforce a single-use restriction intended solely for the purpose of preventing competition, and it does not indicate that the consuming public is ever made aware of the fact that purchasing products are subject to a single-use restriction. *Static Control II* is the only decision post-*Quanta* to consider the validity of the Return Program, and in that case, the district court found the Return Program invalid. Impression Products claims that all of the cases relied upon by Lexmark are distinguishable and do not make the Return Program valid and enforceable.

Lexmark argues in its surreply that Impression Products concedes that *Mallinckrodt*, 976 F.2d 700, controls in regards to use-based restrictions, that there is no Federal Circuit precedent indicating *Mallinckrodt* was overruled, that Impression Products improperly relies on matters



outside the pleadings, and that Impression Products improperly speculates as to the reasons Lexmark implemented its Return Program.

Impression Products argues in its opposition to the surreply that *Mallinckrodt*, 976 F.2d 700, does not stand for the proposition that any and all post-sale restrictions are legal and enforceable. It argues that Lexmark's Return Program is plainly implemented for improper purposes.

#### IV. ANALYSIS

The issue presented is whether the Return Program is invalid as a matter of law. Having considered the relevant caselaw and the briefings of the parties, the Court finds that Lexmark's patent infringement claims are barred as a matter of law by the doctrine of patent exhaustion and must be dismissed.

The issue of patent exhaustion in regards to conditional sales and licenses is not a new one. Courts have been grappling with the issue since as the mid-19th Century when the Supreme Court rendered its decision on patent exhaustion in *Bloomer v. McQuewan*, 55 U.S. 539, 549, 14 L. Ed. 532 (1853). The question before the Supreme Court was whether purchasers of licenses to sell or use the planning machines for the duration of the original patent term could continue to use the licenses through the extended term. *Id.* at 548. The Supreme Court held that the extension of the patent term did not affect the rights already secured by purchasers who bought the item for use "in the ordinary pursuits of life." *Id.* at 549; *see also Quanta*, 553 U.S. at 625. In reaching that decision, the Supreme Court recognized the distinction between purchasers of the right to manufacture and sell patents articles and end users of those articles. It explained:

The franchise which the patent grants, consists altogether in the right to exclude every one from making, using, or vending the thing patented, without the permission of the patentee. This is that he obtains by the patent. And when he sells the exclusive privilege of making or vending it for use in a particular place, the purchaser buys a portion of the franchise which the

patent confers. He obtains a share in the monopoly, and that monopoly is derived from, and exercised under, the protection of the United States. And the interest he acquires, necessarily terminates at the time limited for its continuance by the law which created it. The patentee cannot sell it for a longer time. And the purchaser buys with reference to that period; the time for which exclusive privilege is to endure being one of the chief elements of its value. He therefore has no just claim to share in a further monopoly subsequently acquired by the patentee. He does not purchase or pay for it.

But the purchaser of the implement or machine for the purpose of using it in the ordinary pursuits of life, stands on different ground. In using it, he exercises no rights created by the act of Congress, nor does he derive title to it by virtue of the franchise or exclusive privilege granted to the patentee. The inventor might lawfully sell it to him, whether he had a patent or not, if no other patentee stood in his way. And when the machine passes to the hands of the purchaser, it is no longer within the limits of the monopoly. It passes outside of it, and is no longer under the protection of the act of Congress. And if his right to the implement or machine is infringed, he must seek redress in the courts of the State, according to the laws of the State and not in the courts of the United States, nor under the law of Congress granting the patent. The implement or machine becomes his private, individual property, not protected by the laws of the United States, but by the laws of the State in which it is situated.

*McQuewan*, 55 U.S. at 549-50.

Numerous decisions concerning patent exhaustion in relation to sales and licenses have followed *McQuewan*. Rather than revisiting every one of those relevant opinions here, the Court briefly summarizes only the most relevant of the cases relied upon by the parties in their briefings.

The first post-*McQuewan* case to consider is *General Talking Pictures Corporation v. Western Electric Company*, 304 U.S. 175, 58 S. Ct. 849, 82 L. Ed. 1273 (1938). In that case, a patent owner licensed another company the right to manufacture and sell patented sound amplifiers only for private, non-commercial use. *Id.* The licensee, however, knowingly sold the amplifiers to a commercial user, who also was aware that the sale was outside the scope of the license. *Id.* at 180. The Supreme Court explained that patentees may restrict their licensees to certain uses of licensed technology as long as the restrictions do not "extend the scope of the

monopoly." *Id.* at 181. Given that the licensee sold the patented product in violations of the field-of-use restriction, the sale was unauthorized and did not result in patent exhaustion. *Id.* Both the licensee and the purchasers were thus found to be bound by the restriction. *Id.* at 180-81.

Although multiple cases followed *General Talking Pictures*, the Court moves forward in time to the decision in *Mallinckrodt, Inc. v. Medipart, Inc.*, 976 F.2d 700, 701 (Fed. Cir. 1992), which is central to the parties' dispute. There, the Federal Circuit held that a "single use only" restriction, which accompanied the first sale of a device from the patent owner directly to hospitals and that required disposal of the device after the first use, was a valid and enforceable license. *Id.* It reasoned that generally, "any conditions which are not in their very nature illegal with regard to this kind of property, imposed by the patentee and agreed to by the licensee for the right to manufacture or use or sell the [patented] article, will be upheld by the courts." *Id.* at 703. In reaching that decision, the circuit court considered multiple prior cases. *Id.* at 704-07. Based upon the totality of those cases, the circuit court determined the fact that "a restrictive license is legal seems clear." *Id.* at 704 (citing *Mitchell v. Hawley*, 83 U.S. 544, 21 L. Ed. 322). "[T]he patentee may grant a license upon any condition the performance of which is reasonably within the reward which the patentee by the grant of the patent is entitled to secure." *Id.* at 704-05 (internal quotations omitted). "Unless the condition violates some other law or policy (in the patent field, notably the misuse or antitrust law), private parties retain the freedom to contract concerning conditions of sale." *Id.* at 708 (internal citation omitted). Thus, according to the Federal Circuit, if the restriction is found to "be reasonably within the patent grant, *i.e.*, that it relates to subject matter within the scope of the patent claims, that ends the inquiry." *Id.* at 708. If the inquiry leads "to the conclusion that there are anticompetitive effects extending beyond the

patentee's statutory right to exclude, these effects do not automatically impeach the restriction" as anti-competitive effects that are not *per se* violations of law "are reviewed in accordance with the rule of reason." *Id.*<sup>2</sup>

The Ninth Circuit's decision in *Arizona Cartridge Remanufacturers Association Inc. v. Lexmark International, Inc.*, 421 F.3d 981 (9th Cir. 2005) that followed *Mallinckrodt* specifically concerned Lexmark's Prebate Program. In that case, the circuit court considered whether Lexmark's advertising of its Prebate Program under which it gave purchasers an up-front discount in exchange for an agreement to return the empty cartridge to Lexmark for remanufacturing mislead customers into thinking the post-sale restriction was enforceable. *Id.* The plaintiff did not challenge the district court's holding that Lexmark's patent rights were not exhausted because it "could condition the use of its patented Prebate cartridges by consumers under the principle articulated by the Federal Circuit in *Mallinckrodt, Inc. v. Medipart, Inc.*, which held that a restriction on a patented good is permissible as long as it is 'found to be reasonably within the patent grant, *i.e.*, that it relates to subject matter within the scope of the patent claims.'" *Arizona Cartridge*, 421 F.3d at 986 (quoting *Mallinckrodt*, 976 F.2d at 708). Nor did it argue that Lexmark acted beyond the scope of its patent. *Id.* Instead, it challenged whether Lexmark had a valid contract with the consumers of its product. *Id.* at 987. The circuit court determined that Lexmark presented sufficient un rebutted evidence that it had a facially valid contract because the language on the outside of the cartridge package specified the terms under which the consumer could purchase the item, which the consumer could read prior to

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<sup>2</sup> This is the concept of patent misuse. The *Mallinckrodt* court noted that the defense requires a factual determination as to whether the overall effect of the license tends to restrain competition unlawfully in an appropriately defined relevant market. 976 F.2d at 706 (citing *Windsurfing Int'l v. AMF, Inc.*, 782 F.2d 995 (Fed. Cir.), *cert. denied*, 477 U.S. 905, 106 S. Ct. 3275, 91 L. Ed. 2d 565 (1986)).

determining whether to purchase the product. *Id.* It distinguished that case from instances in which the consumer did not have notice of the condition at the time of purchase. *Id.* at 987 n. 6.

The Lexmark Prebate Program next was addressed in *Static Control Components, Inc. v. Lexmark International, Inc.*, 487 F. Supp. 2d 830, 846-48 (E.D. Ky. 2007) ("*Static Control I*"), where the district court held that Lexmark's Prebate Program survived summary judgment due to the valid restrictive licenses contained on the packaging of the prebate cartridges. In so holding, it rejected the notion that the sale of the cartridges to the middlemen before the end user who is bound by the Prebate Program agreement constituted an unrestricted sale that exhausted the patent rights of Lexmark. *Id.* at 847. The district court relied, in part, on the Federal Circuit's guidance in *Mallinckrodt* that the legality of restrictive licenses "seems clear." *Id.* at 848-49 (citing *Mallinckrodt*, 976 F.2d at 704).

Following *Static Control I*, the Supreme Court granted certiorari in *Quanta Computer, Inc. v. LG Electronics, Inc.*, 553 U.S. 617, 128 S. Ct. 2109, 170 L. Ed. 2d 996 (2008), to consider whether the license agreement for computer technology patents of LG Electronics precluded exhaustion of the patent rights of LG Electronics. LG Electronics had prevailed before the Federal Circuit on the basis that the agreement between LG Electronics and Intel imposed express conditions on the licensed products, that Quanta had express notice that Intel's sales were conditional, and that the conditions survived exhaustion under *Mallinckrodt*. See *LG Elecs., Inc. v. Bizcom Elecs., Inc.*, 453 F.3d 1364, 1370-71 (Fed. Cir. 2006). The Supreme Court, however, did not expressly reference *Mallinckrodt* in its decision, holding that the License Agreement and Master Agreement between LGE and Intel were dispositive. *Quanta*, 553 U.S. 636-38. It reasoned that the License Agreement and the Master Agreement were independent instruments, and the requirement that Intel notify its customers of use restrictions appeared only in the Master

Agreement. *Id.* at 636. That restriction thus did not affect Intel's rights under the License Agreement, which imposed no conditions on Intel's ability to sell to consumers. *Id.* at 636-37. As such, the Supreme Court determined that the agreements broadly authorized Intel to sell the licensed products without restrictions or conditions such that the patent rights were exhausted, even though Quanta was aware of the condition. *Id.* at 637-38. In so holding, the Supreme Court stated: "The authorized sale of an article that substantially embodies a patent exhausts the patent holder's rights and prevents the patent holder from invoking patent law to control postsale use of the article." *Id.* at 638.

After *Quanta*, the *Static Control I* decision was reconsidered by the district court. In *Static Control II*, 615 F. Supp. 2d at 582, the district court held that *Quanta* represented a change in the law of patent exhaustion that broadened the understanding of patent exhaustion, and whereby a patent-based use restriction through post-sale prebate terms was invalidated. In reaching its decision, the district court considered *Quanta* as well as numerous other Supreme Court cases concerning patent exhaustion. *Id.* at 578-84. Upon consideration, the district court believed that the caselaw "reveals that the Court has consistently held that patent holders may not invoke patent law to enforce restrictions on the post-sale use of their patented products" and that after "the first authorized sale to a purchaser who buys for use in the ordinary pursuits in life, a patent holder's patent rights have been exhausted." *Id.* at 582. Applying those concepts to the Prebate Program, the district court determined that Lexmark "attempts to reserve patent rights in its products through post-sale restrictions on use imposed on its customers[,] which is "what *Quanta* says Lexmark cannot do." *Id.* at 584. The district court noted a distinction between a condition on the right to sell, as was at issue in *Quanta*, and a post-sale condition on use, like the Prebate Program, stating that the sales of Lexmark cartridges exhausted Lexmark's patent rights

and stripped its ability to control post-sale use of the cartridges through patent law. *Id.* at 585. Based upon that analysis, the district court noted its belief that *Quanta* overruled *Mallinckrodt* sub silentio. *Id.* On appeal, however, the Sixth Circuit declined to decide the validity of the Prebate Program, noting that the question was extremely complex and unsettled, and that its resolution would not be relevant to the outcome of the appeal. *Static Control Components, Inc. v. Lexmark Int'l, Inc.*, 697 F.3d 387, 421 (6th Cir. 2012).

In *Princo Corporation v. International Trade Commission*, 616 F.3d 1318 (Fed. Cir. 2010), *cert. denied*, 2011 U.S. LEXIS 3703 (May 16, 2011), the Federal Circuit considered the doctrine of patent misuse in the context package licenses containing field-of-use restrictions for recordable compact discs and rewritable compact discs. Philips and Sony offered patent licenses to make the CD-R or CD-RW discs with a field-of-use restriction that limited the licensees to using the licensed patents to produce discs according to the Orange Book standards. *Id.* at 1322. Explaining that patent misuse in the licensing context is a doctrine that limits a patentee's right to impose conditions on a licensee that exceed the scope of the patent, the circuit court determined that it did not bar the intervenor from enforcing patent rights against Princo. *Id.* at 1322, 1328. In reaching its decision, the circuit court relied upon *B. Braun Medical, Inc. v. Abbott Laboratories*, 124 F.3d 1419 (Fed. Cir. 1997) and *Mallinckrodt*, 976 F.2d 700, in explaining the rationale underlying the doctrine:

As a general matter, the unconditional sale of a patented device exhausts the patentee's right to control the purchaser's use of the device thereafter, on the theory that the patentee has bargained for, and received, the full value of the goods. That "exhaustion" doctrine *does not apply, however, to a conditional sale or license*, where it is more reasonable to infer that a negotiated price reflects only the value of the "use" rights conferred by the patentee. Thus, express conditions accompanying the sale or license of a patented product, such as field of use limitations, are generally upheld. . . . When those contractual conditions violate public policy, however, as in the case of price-fixing conditions and tying restraints, the underlying patents

become unenforceable, and the patentee loses its right to sue for infringement or breach of contract.

*Princo*, 616 F.3d at 1328. The circuit court further recognized that the scope of the patent misuse doctrine is narrow because "the patent grant entitles the patentee to impose a broad range of conditions in licensing the right to practice the patent[.]" *Id.* at 1329.<sup>3</sup>

Here, the Court is persuaded to follow the reasoning of the district court in *Static Control II*. Consistent with the *Static Control II* court's analysis, this Court's review of the relevant caselaw does not reflect an endorsement by the Supreme Court of post-sale use restrictions once goods are placed into the ordinary stream of commerce. *See Static Control II*, 615 F. Supp. 2d at 578-83 (explaining relevant caselaw). Further, the Court cannot square the *Quanta* decision with the facts alleged by Lexmark as to its Return Program. In *Quanta*, the consumers had notice of the conditions of the sale, yet the Supreme Court still held that the patent rights of LG Electronics had been exhausted after the first unrestricted authorized sale by its licensee Intel. Those facts parallel this case. Lexmark does not allege that the authority of the sellers of the Return Program cartridges were restricted or conditioned in any way. In other words, the facts alleged by Lexmark do not suggest that the sellers had anything other than full authority to sell the Return Cartridges that practiced Lexmark's patents. Instead, Lexmark alleges only that the Return Program cartridges contained notices of a license restriction which bound the ultimate purchaser. Under *Quanta*, those post-sale use restrictions do not prevent patent rights from being exhausted given that the initial sales were authorized and unrestricted. Thus, to the extent that

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<sup>3</sup> Although Lexmark also cites to *Monsanto Company v. Bowman*, 657 F.3d 1341, 1347 (Fed. Cir. 2011) and *Fujifilm Corp. v. Benum*, 605 F.3d 1366, 1371-72 (Fed. Cir. 2010), those cases are not helpful to the analysis of this issue. *Monsanto* cited *Mallinckrodt* only when explaining the Federal Circuit's reasoning in two cases decided pre-*Quanta*. *Monsanto*, 657 F.3d at 1347. Its decision, however, did not endorse those principles, holding that even if the patents had been exhausted as to the first generation self-replicating seeds, no authorized sale had occurred to exhaust the right in the second generation seeds. *Id.* As for *Fujifilm*, it considered *Quanta* in regards to the territorial requirement for patent exhaustion, which is not the issue presently before the Court. *Fujifilm*, 605 F.3d at 1371-72.



*Mallinckrodt* holds that such post-sale use restrictions preclude patent exhaustion after an authorized sale, the Court agrees with the *Static Control II* court that *Mallinckrodt* was overruled by *Quanta* sub silentio. See *Ninestar Tech. Co. v. Int'l Trade Comm'n*, 667 F.3d 1373, 1378 (Fed. Cir. 2012) (suggesting that an appellate court decision should not be found overturned by new Supreme Court precedent unless it is plainly inconsistent with that precedent); *Fujifilm Corp. v. Benum*, 605 F.3d 1366, 1371 (Fed. Cir. 2010) (similar to *Ninestar*); *Static Control II*, 615 F. Supp. 2d 575 (E.D. Ky. 2009) (similar to *Ninestar*). Although the Court recognizes that *Princo* cited to *Mallinckrodt* with approval in considering the doctrine of patent misuse, that case concerned license restrictions that limited the use of the patent to manufacture and produce the product in accordance with certain standards. It did not concern products that had been placed into the stream of commerce for use in ordinary pursuits in life. *Princo's* reliance on *Mallinckrodt* thus does not demonstrate a continued endorsement of it in regards to the type of post-sale use restrictions at issue in this case.

A contrary holding would not only be inconsistent with *Quanta*, but would also create significant uncertainty for downstream purchasers and end users who may continue to liable for infringement even after an authorized sale to the consumer has occurred. Therefore, the Court is persuaded that the fully authorized sales of the Return Program cartridges to consumers for use in the ordinary pursuits in life took the cartridges outside the scope of the patent monopoly despite the notices contained on those cartridges, and Lexmark may not now rely on patent law to hold Impression Products liable for infringement.

## V. CONCLUSION

For the foregoing reasons, Impression Products' Second Motion to Dismiss (Doc. 395) is **GRANTED**. The infringement claims against Impression Products based upon the Return Program cartridges are hereby **DISMISSED**.

**IT IS SO ORDERED.**

s/Michael R. Barrett  
Michael R. Barrett, Judge  
United States District Court



remanufactured inkjet cartridges to others, including customers in the United States. Lexmark contends that Defendant Impression Products, Inc. ("Impression Products") was one of those defendants that sold in the United States remanufactured inkjet cartridges that had originally been sold outside of the United States thereby infringing Lexmark's patent.

## II. LEGAL STANDARD

In reviewing a motion to dismiss for failure to state a claim, this Court must "construe the complaint in the light most favorable to the plaintiff, accept its allegations as true, and draw all reasonable inferences in favor of the plaintiff." *Bassett v. Nat'l Collegiate Athletic Ass'n*, 528 F.3d 426, 430 (6th Cir. 2008) (quoting *Directv, Inc. v. Treesh*, 487 F.3d 471, 476 (6th Cir. 2007)). "[T]o survive a motion to dismiss[,] a complaint must contain (1) 'enough facts to state a claim to relief that is plausible,' (2) more than 'a formulaic recitation of a cause of action's elements,' and (3) allegations that suggest a 'right to relief above a speculative level.'" *Tackett v. M&G Polymers, USA, LLC*, 561 F.3d 478, 488 (6th Cir. 2009) (quoting *Bell Atlantic Corp. v. Twombly*, 550 U.S. 544, 127 S. Ct. 1955, 1965, 1974, 167 L. Ed. 2d 929 (2007)). A claim has facial plausibility when the pleaded factual content allows the court to draw the reasonable inference that the defendant is liable for the misconduct alleged. *Ashcroft v. Iqbal*, 556 U.S. 662, 663, 129 S. Ct. 1937, 173 L. Ed. 2d 868 (2009). Although the plausibility standard is not equivalent to a "probability requirement," . . . it asks for more than a sheer possibility that a defendant has acted unlawfully." *Id.* at 678 (quoting *Twombly*, 550 U.S. at 556). However, the Court is "not bound to accept as true a legal conclusion couched as a factual allegation." *Papasan v. Allain*, 478 U.S. 265, 286, 106 S. Ct. 2932, 92 L. Ed. 2d 209 (1986); *see also In re Sofamor Danek Grp.*, 123 F.3d 394, 400 (6th Cir. 1997) (stating that a court "'need not accept as

true legal conclusions or unwarranted factual inferences") (quoting *Morgan v. Church's Fried Chicken*, 829 F.3d 10, 12 (6th Cir. 1987)).

### III. ANALYSIS

The patent exhaustion doctrine generally provides that once a patentee has made an unrestricted sale of a patented article, the patentee loses its right to control the sale, offer for sale, or use of the article. *Bowman v. Monsanto Co.*, \_\_\_ U.S. \_\_\_, 133 S. Ct. 1761, 1764, 185 L. Ed. 2d 931 (2013); *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 128 S. Ct. 2109, 170 L. Ed. 2d 996 (2008). According to a 2001 decision of the Federal Circuit, the patent exhaustion doctrine is territorial. *Jazz Photo Corporation v. International Trade Commission*, 264 F.3d 1094, 1105 (Fed. Cir. 2001). That means that in order for patent exhaustion to apply, the authorized first sale must have occurred in the United States. *Id.* ("United States patent rights are not exhausted by products of foreign provenance. To invoke the protection of the first sale doctrine, the authorized first sale must have occurred under the United States patent."). The *Jazz Photo* decision relies upon a United States Supreme Court decision from 1890 in which the Court held that an authorized sale of a good patented by another under the laws of a foreign country does not exhaust the patent rights of the United States patentee, and the United States patentee may sue for infringement when that good is imported into the United States for sale. *Id.* (citing *Boesch v. Graff*, 133 U.S. 697, 701-03, 10 S. Ct. 378, 33 L. Ed. 787 (1890)). Thus, under *Jazz Photo*, an initial authorized sale of a patented product outside of the United States would not exhaust the patent rights of the patent holder. *See id.*

Recently, the Supreme Court addressed the parallel "first sale" doctrine under copyright law. *Kirtsaeng v. John Wiley & Sons, Inc.*, \_\_\_ U.S. \_\_\_, 133 S. Ct. 1351, 1354, 185 L. Ed. 2d 392 (2012). The Supreme Court's decision was rooted in interpretation of a statutory provision of

copyright law. *Id.* at 1357-71. Specifically, the Supreme Court considered whether the phrase "lawfully made under this title" restricts the scope of the first sale doctrine geographically. *Id.* at 1357 (citing 17 U.S.C. 109(a)). The plaintiff contended that "lawfully made under this title" imposed a geographical limitation that prevented the first sale provision from applying to its books first manufactured and sold overseas. *Id.* at 1357-58. The defendant, however, read the phrase as imposing a non-geographical limitation that required only that the book be made in compliance with the Copyright Act such that a first manufacture and sale abroad would extinguish the rights of the copyright owner. *Id.* at 1358. The Supreme Court determined that the plain language of the provision said nothing about geography and that interpreting the provision not to provide a geographical limitation made linguistic sense and did not present the same difficulties as an interpretation that included a geographical limitation. *Id.* at 1358-71.

However, the Supreme Court's analysis did not end there. It next considered the context of the statutory provision. *Kirtsaeng*, 133 S. Ct. at 1360. According to the Supreme Court, the legislative history of the statutory provision indicates that Congress did not have geography in mind when writing the present version of section 109(a). *Id.* Additionally, it determined that other provisions of the current statute supported a non-geographical interpretation. *Id.* at 1361-62. For example, the "manufacturing clause," which limited importation of many copies printed outside the United States, was phased out in an effort to equalize treatment of copies made in America and copies made abroad. *Id.* The Supreme Court had difficulty squaring that "equal treatment" principle with a first sale doctrine that imposed geographical limitations. *Id.* at 1362.

The Supreme Court also considered whether canons of statutory interpretation favored a geographical limitation. In particular, it considered the common law history of the first sale doctrine by applying the canon of statutory interpretation that "[w]hen a statute covers an issue

previously governed by the common law," it is presumed that "Congress intended to retain the substance of the common law." *Kirtsaeng*, 133 S. Ct. at 1363 (citing *Samantar v. Yousuf*, 560 U.S. 305, n. 13, 130 S. Ct. 2278, 176 L. Ed. 2d 1047 (2010)). Applying that canon, the Supreme Court traced the doctrine back to the Seventeenth Century where Lord Coke explained the common law's refusal to permit restraints on the alienation of chattels. *Id.* The Supreme Court noted that a law permitting a copyright holder to control the resale or other disposition of a chattel once sold is "'against Trade and Traffi[c], and bargaining and contracting." *Id.* (quoting L. E. Coke, *Institutes of the Laws of England*, § 360, p. 223 (1628)). It further recognized the same principle of freedom to resell can work to the advantage of the consumer and frees the courts from the administrative burden of trying to enforce restrictions upon difficult-to-trace, readily movable goods, and avoids selective enforcement inherent in any such effort. *Id.* (citing *Leegin Creative Leather Prods. v. PSKS, Inc.*, 551 U.S. 877, 127 S. Ct. 2705, 168 L. Ed. 2d 623 (2007)). Accordingly, the Supreme Court determined that common law of the first sale doctrine "makes no geographical distinctions." *Id.*

The Supreme Court then considered the practical difficulties of placing geographical limitations on the first sale doctrine. *Kirtsaeng*, 133 S. Ct. at 1364. The libraries, in particular, would have difficulty maintaining their collections of foreign books that do not contain a copyright holder's present address or in negotiating fees for those copyrights after first sale. *Id.* at 1365-66. Other manufacturers and retailers of goods would face similar restrictions. *Id.* at 1365. A geographical limitation would prevent the resale of a car without the permission of the holder of each copyright on each piece of copyrighted automobile software, and it also would prevent retailers from buying and selling goods packaged abroad that contain copyrighted logos, labels, and instructions. *Id.* Similarly, museums would have to obtain the permission of a

copyright owner to display a foreign work, even if the copyright owner already sold or donated the work to a foreign museum. *Id.* Also of some importance was that many had relied on the first sale doctrine's protection in their businesses due to the unsettled nature of the doctrine. *Id.* at 1366.

Finally, the Supreme Court considered the defendant's arguments that a geographical interpretation was favored. *Kirtsaeng*, 133 S. Ct. at 1367-71. One particular issue addressed was the division of markets. *Id.* at 1370. The Supreme Court determined that there was "no basic principle of copyright law that suggests that publishers are especially entitled to such rights." *Id.* at 1370. Rather, "Congress enacted a copyright law that (through the 'first sale' doctrine) limits copyright holders' ability to divide domestic markets." *Id.* at 1371. That limitation is consistent with antitrust laws. *Id.* In the Supreme Court's view, "[w]hether copyright owners should, or should not, have more than ordinary commercial power to divide international markets is a matter for Congress to decide . . . [and the Supreme Court does] no more here than try to determine what decision Congress has taken." *Id.*

Based on the entirety of its analysis, the Supreme Court held that "[i]n our view, § 109(a)'s language, its context, and the common-law history of the first sale doctrine, *taken together*, favor a non-geographical interpretation. We also doubt that Congress would have intended to create the practical copyright-related harms with which a geographical interpretation would threaten ordinary scholarly, artistic, commercial and consumer activities." *Id.* at 1358 (emphasis added).

Here, the core dispute between Lexmark and Impression Products is whether the United States Supreme Court's March 19, 2013 decision in *Kirtsaeng*, 133 S. Ct. 1351, overturns the Federal Circuit's decision in *Jazz Photo*, 264 F.3d 1094, such that Lexmark's patent rights were



exhausted upon the first authorized sale abroad.<sup>2</sup> Other courts that have considered the continuing validity of an appellate court decision in light of new Supreme Court precedent have suggested that an appellate court decision should not be overturned unless it is plainly inconsistent with the Supreme Court precedent. *See Ninestar Tech. Co. v. Int'l Trade Comm'n*, 667 F.3d 1373, 1378 (Fed. Cir. 2012); *Fujifilm Corp. v. Benun*, 605 F.3d 1366, 1371 (Fed. Cir. 2010); *Static Control Components, Inc. v. Lexmark Int'l, Inc.*, 615 F. Supp. 2d 575 (E.D. Ky. 2009).

In this instance, the balance of considerations weighs in favor of finding that *Kirtsaeng* is not plainly inconsistent with *Jazz Photo*. An obvious distinction between the two cases is that *Jazz Photo* involved patent law whereas *Kirtsaeng* involved only copyright law. Indeed, nowhere in *Kirtsaeng* is there any express mention or consideration of patents, the patent exhaustion doctrine, or patent exhaustion's territoriality requirement. Although a lack of express mention or consideration of the patent exhaustion doctrine does not automatically preclude application of *Kirtsaeng* to patent law, the Federal Circuit recently has reinforced that copyright cases are not "controlling" regarding patent issues. *Lifescan Scotland, Ltd. v. Shasta Techs., LLC*, 734 F.3d 1361, 2013 U.S. App. LEXIS 22332, at \*38 (Fed. Cir. Nov. 4, 2013) (citing *Bobbs-Merrill Co. v. Straus*, 210 U.S. 339, 346, 28 S. Ct. 722, 52 L. Ed. 1086 (1908)). In fact, the Supreme Court historically has been reluctant to readily consider copyright cases and patent cases interchangeably, noting that the protections afforded by copyright law and patent law are different. *See Bobbs-Merrill*, 210 U.S. at 346.<sup>3</sup> Moreover, the Federal Circuit has acknowledged

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<sup>2</sup> In the context of patents, courts have used the term "patent exhaustion" interchangeably with "first sale." For clarity purposes, the Court primarily will refer to "first sale" in the context of copyrights and to "exhaustion" in the context of patents, except where otherwise necessary or appropriate.

<sup>3</sup> In *Bobbs-Merrill*, the Supreme Court was reluctant to accept patent law cases on first sale as being directly binding for copyright law. 210 U.S. at 345-46. There, the copyright owner relied on prior patent cases as supporting a right to impose conditions on sale. *Id.* at 342. The Supreme Court recognized that there were

that the patent exhaustion doctrine does not squarely align with first sale provision of the Copyright Act, even though they are similar doctrines. *Fuji Photo Film Co., Ltd. v. Int'l Trade Comm'n*, 474 F.3d 1281, 1294 (Fed. Cir. 2007) (acknowledging that patent rights are exhausted through a first sale in the United States whereas "[a] different rule applies in the copyright context"). In that respect, the law weighs against finding that *Kirtsaeng* overturned *Jazz Photo* sub silentio.

Other factors also weigh against a finding that *Kirtsaeng* overturned *Jazz Photo*. The decision in *Kirtsaeng* is rooted in statutory and legislative interpretation of section 109(a) of the Copyright Act. 17 U.S.C. § 109(a). Noticeably absent from patent law is a codification of the exhaustion doctrine. Rather, the patent exhaustion doctrine, including its territoriality requirement, is grounded in judicial precedent. See *Jazz Photo*, 264 F.3d at 1105. As such, unlike in *Kirtsaeng*, there is no statutory provision or legislative history of the exhaustion doctrine that favors a non-geographical interpretation. Thus, the core statutory text that weighed in favor of a non-geographical interpretation is non-existent in the context of patent law.

The lack of a codified patent exhaustion doctrine means that there may be more leeway for understanding and interpreting the doctrine. While Lord Coke's policy provides a natural starting place since that policy undergirds the patent exhaustion doctrine, it is not the only factor to be considered. See *Lifescan Scotland*, 2013 U.S. App. LEXIS 22332, at \*39-40 (recognizing that the same policy underlying the first sale doctrine also undergirds the doctrine of patent exhaustion) (citing *Straus v. Victor Talking Mach. Co.*, 243 U.S. 490, 500-01, 37 S. Ct. 412, 61 L. Ed. 866 (1917)). Importantly, the patent exhaustion doctrine's history differs from the history

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differences in the extent of protections granted by copyright law and patent law. *Id.* at 346. As such, *Bobbs* teaches that the common law on patent exhaustion does not automatically transfer to copyright law. The contrary presumably also is true – that is, that law on copyright's first sale doctrine does not automatically transfer to patent law's exhaustion doctrine.

of the first sale doctrine addressed in *Kirtsaeng*. In *Kirtsaeng*, the Supreme Court considered what common law of the first sale doctrine existed prior to the codification of the doctrine in the Copyright Act of 1909, which subsequently was superseded by the Copyright Act of 1976. *Kirtsaeng*, 133 S. Ct. at 1363. In doing so, it looked to the last Supreme Court decision prior to the 1909 codification to determine if it indicated any intent to impose a geographical restriction. *Id.* at 1353. Finding no geographical restriction in that Supreme Court precedent, the Supreme Court concluded that the common law principles set forth by Lord Coke still were followed at the time of codification and had never been modified by Congress. *Id.* at 1363. Since the doctrine of patent exhaustion is not codified, the same reasons for considering and applying Lord Coke's principles are not present.

In contrast to the first sale doctrine, the patent exhaustion doctrine has evolved through Supreme Court and lower court decisions, and it remains premised upon those decisions. In particular, *Jazz Photo*, 264 F.3d 1094, is a decision that interprets the prior Supreme Court precedent on patent exhaustion to determine how it applies in the context of first sales abroad. The Supreme Court in *Kirtsaeng* did not specifically consider the evolution of a common law principle through Supreme Court decisions on patent exhaustion and the subsequent interpretations thereof. It also did not foreclose the possibility that the first sale principles articulated by Lord Coke could be and were modified by the Supreme Court and lower courts in the patent context. *See Kirtsaeng*, 133 S. Ct. at 1353 (considering whether a geographical distinction could be found in the Supreme Court case that first applied the first sale provision one year prior to its codification).

Moreover, *Kirtsaeng* suggests that Lord Coke's principles should not be applied in a vacuum. Rather, it is necessary to consider the context, history and practical considerations to

determine the proper application of the patent exhaustion doctrine to first sales abroad. *See Kirtsaeng*, 133 S. Ct. at 1358. Part of that context and history is *Jazz Photo* and its progeny, the Supreme Court precedent on which *Jazz Photo* relies, other judicial decisions concerning the patent exhaustion doctrine, and the practical patent-specific implications of a territoriality requirement for patent exhaustion. Those particular considerations were not addressed in *Kirtsaeng* nor were they thoroughly explained or analyzed by Impression Products.

While the Federal Circuit's recent decision in *Lifescan*, 2013 U.S. App. LEXIS 22332, may provide guidance as to how the Federal Circuit may apply *Kirtsaeng* upon reconsideration of *Jazz Photo*, it does not conclusively demonstrate that *Jazz Photo* is no longer good law. *Lifescan* did not concern the territoriality requirement of patent exhaustion. *See Lifescan*, 2013 U.S. App. LEXIS 22332. Instead, it raised a matter of first impression for the Federal Circuit – whether patent exhaustion applied to a product distributed for free. *Id.* at \*33. Since there was no Supreme Court guidance directly on point, the Federal Circuit looked to prior Supreme Court precedent on the patent exhaustion doctrine in reaching its decision. *Id.* at \*32-38 (citing *Bowman v. Monsanto Co.*, \_\_\_ U.S. \_\_\_, 133 S. Ct. 1761, 1766, 185 L. Ed. 2d 931 (2013); *United States v. Univis Lens Co.*, 316 U.S. 241, 62 S. Ct. 1088, 86 L. Ed. 1408 (1942); *Adams v. Burke*, 84 U.S. (17 Wall.) 453, 21 L. Ed. 700 (1873); *Bloomer v. McQuewan*, 55 U.S. (14 How.) 539, 14 L. Ed. 532 (1852)). After determining that the Supreme Court had never limited the patent exhaustion doctrine to sales only, it then looked to the holding in *Kirtsaeng* merely to reinforce its conclusion that the doctrine was not so limited, even though *Kirtsaeng* was not controlling on issues of patent law. *Id.* at \*38. In particular, the Federal Circuit recognized that Lord Coke's principles undergird the patent exhaustion doctrine and do not draw any distinction between gifts and sales. *Id.* at \*39-40. Therefore, considering the totality of the circumstances, the Federal

Circuit determined a patentee cannot "circumvent the application of patent exhaustion principles by distributing a product embodying a patent for free." *Id.* at \*42.

Here, in contrast to *Lifescan*, the Federal Circuit has determined in *Jazz Photo* that Supreme Court precedent supports a territoriality requirement for patent exhaustion. Thus, Lord Coke's principles are not as easily relied upon as they are in regards to the matter before the Federal Circuit in *Lifescan*. While it is possible that upon revisiting *Jazz Photo* and its cursory reasoning, the Federal Circuit will now give more weight to Lord Coke's policy and the reasoning set forth in *Kirtsaeng*, it is not a foregone conclusion that the policy or the reasoning will be strictly applied. This Court adheres to the view that copyright law and patent law are not identical and offer different protections. Thus, it would be amiss to overlook the distinctions by adopting Impression Products' position that Lord Coke's principles, as applied to the Copyright Act's first sale provision, conclusively demonstrate that *Kirtsaeng* overrules *Jazz Photo* sub silentio.

Reinforcing this Court's reluctance to apply *Kirtsaeng* to patent law is the Supreme Court's denial of certiorari in a case that raised the precise issue currently before this Court. *Ninestar Technology Co., Ltd. v. International Trade Commission*, 667 F.3d 1373 (Fed. Cir. 2012), *cert. denied*, 2013 U.S. LEXIS 2409 (U.S., Mar. 25, 2013).<sup>4</sup> That denial of certiorari was issued on the same day the Supreme Court remanded two others copyright cases to be considered in light of its decision in *Kirtsaeng*. *See Kumar v. Pearson Educ., Inc.*, \_\_\_ U.S. \_\_\_, 133 S. Ct. 1631, 185 L. Ed. 2d 614 (2013); *Liu v. Pearson Educ. Inc.*, \_\_\_ U.S. \_\_\_, 133 S. Ct. 1630, 185 L.

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<sup>4</sup> The Federal Circuit had relied upon *Jazz Photo* in holding that United States patent rights are not exhausted by products of foreign provenance. *Ninestar Tech. Co. v. ITC*, 667 F.3d 1373, 1378 (Fed. Cir. 2012). In so holding, it rejected the argument that *Jazz Photo* had been overruled by *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 632 n.6, 128 S. Ct. 2109, 170 L. Ed. 2d 996 (2008) because neither the facts nor the law in *Quanta* concerned the importation into the United States of a product not made or sold under a United States patent. *Id.* Thus, while the principles of *Quanta* may be subject to application for products first sold domestically, the Federal Circuit has rejected their application for products first sold overseas.

Ed. 2d 613 (2013). That denial of certiorari, while not conclusive, certainly suggests that *Jazz Photo* remains for now the controlling case on whether patent rights are exhausted by a first authorized sale abroad.

In so ruling, however, the Court does not intend to determine that *Jazz Photo* ultimately should stand in light of *Kirtsaeng*. The Court is cognizant that many of the reasons for rejecting a territoriality requirement for copyright law may apply equally to patent law. Nevertheless, given the complete lack of consideration of the context, history and practical implications of international patent exhaustion in *Kirtsaeng*, the Court concludes that the Supreme Court did not intend to implicitly overrule *Jazz Photo* and that *Jazz Photo* remains controlling precedent on patent exhaustion abroad.

## IV. CONCLUSION

Accordingly, Impression Products' Motion to Dismiss (Doc. 335) is **DENIED**.

**IT IS SO ORDERED.**

s/Michael R. Barrett  
Michael R. Barrett, Judge  
United States District Court

**UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CASE NO. 1:10-cv-00564-MRB**

**LEXMARK INTERNATIONAL, INC.**  
**Plaintiff**

V.

INK TECHNOLOGIES PRINTER SUPPLIES, LLC  
*et al*  
Defendants

## **STIPULATED PERMANENT INJUNCTION**

This matter is before the Court on the stipulated motion of Plaintiff Lexmark International, Inc. (“Lexmark”) and Defendant Impression Products, Inc. (“Impression”) for entry of this Stipulated Permanent Injunction. (Doc. 661).

**IT IS HEREBY FOUND, ORDERED, ADJUDGED WITH CONSENT OF THE PARTIES that:**

1. Impression, is or has been, among other things, selling remanufactured and compatible toner cartridges in the United States and in foreign countries for use in Lexmark laser printers, including E120, E220, E230, E232, E234, E238, E240, E250, E260, E320, E322, E321, E323, E330, E332, E340, E342, E350, E352, E360, E450, E460, E460, T520, T522, X520, X522, T610, T612, T614, T616, T620, T622, X620, T630, T632, T634, T640, T642, T644, T650, T652, T654, T656, X650, X651, X652, X653, X654, X655, and X656 series printers, and the equivalent monochrome laser printers sold under private label, including the Dell 1700, Dell 1700N, Dell 1710, Dell 1720, Dell 2230, Dell 2330, Dell 2350, Dell 3330, Dell 3333, Dell 3335, Dell 5200, Dell 5210, Dell 5300, Dell 5310, Dell 5230, Dell 5350, Dell 5530, Dell 5535, Dell E220, IBM 1116, IBM 1312, IBM 1412, IBM

1512, IBM 1512N, IBM infoPrint 1120, IBM InfoPrint 1125, IBM Infoprint 1130, IBM Infoprint 1140, IBM InfoPrint 1332, IBM Infoprint 1352, IBM Infoprint 1372, IBM InfoPrint 1532, IBM Infoprint 1552, IBM Infoprint 1572, IBM Infoprint 1832, IBM Infoprint 1850, IBM Infoprint 1852, IBM Infoprint 1860, IBM Infoprint 1870, IBM Infoprint 1872, IBM Infoprint 1880, IBM Infoprint 1892, InfoPrint 1601, InfoPrint 1602, InfoPrint 1612, InfoPrint 1622, Infoprint 1822, IBM Infoprint 1823, IBM Infoprint 1930, IBM Infoprint 1940, Lenovo LI3900, LG 3510, LG 3350, LG 3850, LG 4010, Nashuatec P6220, Nashuatec P6225, Nashuatec P6230, Nashuatec 6240, Okidata MB780, Okidata MB790, Okidata 5500, Okidata 7180, Okidata 7190, Ricoh Afficio SP 4400, Ricoh Afficio SP 4410, Ricoh Afficio SP 4420, Sindoricoh 5000, Sindoricoh 5005, Sindoricoh 5050, Sindoricoh 4450, Sindoricoh 4550, Sindoricoh 4555, Sindoricoh 5450, Sindoricoh 5550, Source Technologies 9116, Source Technologies 9130, Source Technologies 9140, Source Technologies 9325, Source Technologies 9335, Source Technologies 9340, Source Technologies 9530n, Source Technologies 9550, Source Technologies 9552, Source Technologies 9630, Source Technologies 9650, Source Technologies 9620, Source Technologies 9622, Source Technologies ST 9120, Source Technologies 9125, Toshiba e-Studio 20P, Toshiba e-Studio 25P, Toshiba e-Studio 30P, Toshiba e-Studio 40P, Toshiba e-Studio 400P, Toshiba e-Studio430, Toshiba e-Studio 530, Toshiba e-Studio 450P, Toshiba e-Studio 500P, Toshiba e-Studio 500P, Unisys 134, Unisys 136, Unisys UDS 130, Unisys UDS 132, Unisys UDS 640n, Unisys UDS 650n, Unisys UDS 140, Unisys UDS 142, Unisys UDS 540n, Unisys UDS 544n, Unisys UDS 630, Unisys UDS 635dn series printers (the “Accused Cartridges”).



2. Lexmark owns and has standing to sue for infringement of United States Patent Nos. 5,337,032; 5,634,169; 5,758,231; 5,758,233; 5,768,661; 5,802,432; 5,875,378; 5,995,772; 6,009,291; 6,078,771; 6,397,015; 6,459,876; 6,487,383; 6,496,662; 6,678,489; 6,816,692; 6,871,031; 6,879,792; 7,139,510; 7,233,760; and 7,305,204 (the “Lexmark Patents”);

3. The Lexmark Patents are valid and enforceable against Impression.

4. The following table identifies the patent claims of the Lexmark Patents that are satisfied literally by the Accused Cartridges:

| Patents-in-Suit | Accused Cartridges*   |                         |                       |                       |   |                    |                       |
|-----------------|-----------------------|-------------------------|-----------------------|-----------------------|---|--------------------|-----------------------|
|                 | E120                  | E23X/E24X/<br>E33X/E34X | E260/<br>E360/E460    | E25X/<br>E35X/E45X    | T52X/T61X/<br>T62X/T63X/<br>T64X/T65X/<br>X651/X652/<br>X654/X656 | E320/<br>E322      | E220 and<br>E321/E323 |
| 5,337,032       |                       |                         |                       |                       | 1,5,6   |                    |                       |
| 5,634,169       |                       |                         | 32,36,42              |                       | 1-3,32-34,<br>36, 42  | 32,36,42           | 32,36,42              |
| 5,758,231       |                       | 1-16                    | 1-16                  | 1-16                  |   | 1-16               | 1-16                  |
| 5,758,233       |                       |                         |                       |                       | 1-4   |                    |                       |
| 5,768,661       |                       |                         |                       |                       | 1,2,3,6   |                    |                       |
| 5,802,432       |                       |                         |                       |                       | 1-3, 7-9  |                    |                       |
| 5,875,378       |                       |                         |                       |                       | 1-3,12-14,24  |                    |                       |
| 5,995,772       |                       |                         | 14,15,22,<br>32-34    |                       | 1-3,5,7-9,<br>12,14-<br>18,20,21                                  | 14,15,22,<br>32-34 | 14,15,22,<br>32-34    |
| 6,009,291       | 1-2                   | 1-2                     | 1-2                   | 1-2                   | 1-2   |                    |                       |
| 6,078,771       | 1,5,6,10,<br>12,13,15 | 1,5,6,10,<br>12,13,15   | 1,5,6,10,<br>12,13,15 | 1,5,6,10,<br>12,13,15 | 1,2,5,6,10,<br>12,13,15   |                    |                       |
| 6,397,015       |                       |                         | 1,2,4,<br>9,17,19     |                       | 1-4,7-12,<br>14-19,22-24  | 1,2,4,<br>9,17,19  | 1,2,4,<br>9,17,19     |
| 6,459,876       |                       |                         |                       |                       | 1-28  |                    |                       |
| 6,487,383       | 1,2,6,<br>10,15,19    | 1,2,6,<br>10,15,19      | 1,2,6,<br>10,15,19    | 1,2,6,<br>10,15,19    | 1,2,6,10,<br>11,15,19   | 19                 | 19                    |
| 6,496,662       |                       | 1,3,5,7                 |                       | 1,3,5,7               |   |                    |                       |
| 6,678,489       |                       | 5, 6                    | 5, 6                  | 5, 6                  |   |                    |                       |
| 6,816,692       | 1-13                  | 1-13                    | 1-13                  | 1-13                  |   |                    |                       |
| 6,871,031       |                       | 1-6,8-12                | 1-6,8-12              | 1-6,8-12              |   |                    |                       |
| 6,879,792       |                       | 1-11                    | 1-11                  | 1-11                  |   |                    |                       |
| 7,139,510       |                       | 1-10                    | 1-10                  | 1-10                  |   |                    |                       |
| 7,233,760       | 1-10,<br>11,12,14     | 1-10,<br>11,12,14       | 1-10,<br>11,12,14     | 1-10,<br>11,12,14     |   |                    |                       |
| 7,305,204       |                       | 1-20                    | 1-20                  | 1-8,10-13             |   |                    |                       |

\* The private label models corresponding to the Accused Cartridges identified in Table 1 are likewise covered by the respective Patents-in-Suit.

5. Except as permitted in Paragraph 6, this Court permanently enjoins Impression, as well as those persons or companies in active concert or participation with Impression who receive actual notice of the order by personal service or otherwise, from making, using, selling, offering for sale or importing into the United States Accused Cartridges that infringe any of the above-identified patent claims or are not colorably different from the Accused Cartridges.

6. Nothing herein limits or shall be construed to limit in any way Impression's activities with respect to toner cartridges in which Lexmark's patent rights have been exhausted or to redesigned toner cartridges that do not infringe Lexmark's patents. Further, nothing herein limits or shall be construed to limit in any way Impression's activities with respect to any Lexmark Patents that have expired, lapsed, are no longer enforceable, or have found to be invalid by a court of competent jurisdiction. Finally, nothing herein limits or shall be construed to limit in any way Impression's activities outside the United States.

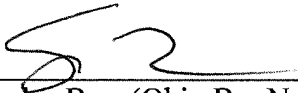
7. This Court retains jurisdiction over Lexmark and Impression to the extent necessary to enforce the terms of this Stipulated Permanent Injunction.

8. This Stipulated Permanent Injunction shall be binding upon and shall inure to the benefit of Lexmark and Impression, as well as each of their respective subsidiaries, corporate parents, affiliates, and/or successors and assigns.

Date: June 23, 2014

s/ Michael R. Barrett  
United States District Judge

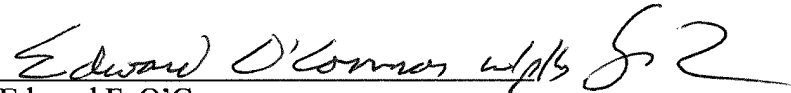
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UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION

LEXMARK INTERNATIONAL, INC.

Plaintiff,

v.

INK TECHNOLOGIES PRINTER SUPPLIES, LLC, ET AL.

Defendants.

Civil Action No.  
1:10-CV-564-MRB

**ORDER ON JOINT MOTION FILED UNDER SEAL ON MAY 29, 2014**

This matter is before the Court on the Joint Motion, filed under seal on May 29, 2014, by Plaintiff Lexmark International, Inc. (“Lexmark”) and Defendant Impression Products, Inc. (“Impression Products”), for Entry of Stipulated Order Regarding Supplementation of Record, Limited Reconsideration to the Extent Necessary to Preserve Appellate Rights, for Non-Infringement with respect to Toner Cartridges First Sold Outside the United States, and for Entry of Final Judgment (“Joint Motion”). (Doc. 661).

**IT IS HEREBY FOUND, ORDERED, ADJUDGED** that:

1. The Joint Motion is granted.
2. In accordance with the Joint Motion, the district court record is hereby supplemented with the stipulations and agreements contained in the Joint Motion as well as the documents attached thereto (collectively, “the Supplemented Record”).
3. Lexmark’s and Impression Products’ joint motion for reconsideration—of the Court’s order (Doc. 615) regarding Impression Products’ Second Motion to Dismiss regarding the invalidity of Lexmark’s Return Program under patent law—is granted based on the Supplemented Record.

4. As stated in the Court's order, the "issue presented" in Impression Products' Second Motion to Dismiss was "whether the Return Program is invalid as a matter of law. Having considered the relevant caselaw and briefings of the parties, the Court finds that Lexmark's patent infringement [based on the Return Program] are barred as a matter of law by the doctrine of patent exhaustion and must be dismissed." (Doc. 615, p. 4).

5. Based on the Supplemented Record, the following portion of the Court' order (Doc. 615, p. 11) is vacated.

Lexmark does not allege that the authority of the sellers of the Return Program cartridges were restricted or conditioned in any way. In other words, the facts alleged by Lexmark do not suggest that the sellers had anything other than full authority to sell the Return Cartridges that practiced Lexmark's patents.

6. After reconsidering Impression Products' Second Motion to Dismiss (Doc. 615) in view of the Supplemented Record, the Court again finds that Lexmark's patent infringement claims based on its Return Program are barred as a matter of law by the doctrine of patent exhaustion and must be dismissed based on the same analysis of patent law set forth in the Court's order of March 27, 2014. (Doc. 615)

Date: June 23, 2014

s/Michael R. Barrett  
\_\_\_\_\_  
MICHAEL R. BARRETT, Judge  
United States District Court

**U.S. District Court  
Southern District of Ohio (Cincinnati)  
CIVIL DOCKET FOR CASE #: 1:10-cv-00564-MRB**

Lexmark International, Inc. v. Ink Technologies Printer Supplies, LLC et al  
Assigned to: Judge Michael R. Barrett  
Case in other court: Federal Circuit Court of Appeals, 14-01617  
Federal Circuit Court of Appeals, 14-01619  
Cause: 35:145 Patent Infringement

Date Filed: 08/20/2010  
Date Terminated: 06/24/2014  
Jury Demand: Both  
Nature of Suit: 830 Patent  
Jurisdiction: Federal Question

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V.

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**Defendant**

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**Defendant**

**E-Toner Mart, Inc.**  
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**Defendant**

**Alpha Image Tech**  
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**Defendant**

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ATTORNEY TO BE NOTICED

**Defendant**

**Laser Toner Technology, Inc.**  
*TERMINATED: 08/02/2011*

represented by **Charles H. Suh**  
(See above for address)  
LEAD ATTORNEY  
PRO HAC VICE  
ATTORNEY TO BE NOTICED

**Michael P Foley**  
(See above for address)  
LEAD ATTORNEY  
ATTORNEY TO BE NOTICED

**Richard L Stroup**  
(See above for address)  
PRO HAC VICE  
ATTORNEY TO BE NOTICED

**Defendant**

**CRServices, Incorporated**  
*TERMINATED: 08/02/2011*  
*doing business as*  
CRDistributors  
*TERMINATED: 08/02/2011*  
*doing business as*  
CRDistributing  
*TERMINATED: 08/02/2011*

represented by **Charles H. Suh**  
(See above for address)  
LEAD ATTORNEY  
PRO HAC VICE  
ATTORNEY TO BE NOTICED

**Michael P Foley**  
(See above for address)  
LEAD ATTORNEY  
ATTORNEY TO BE NOTICED

**Richard L Stroup**  
(See above for address)  
PRO HAC VICE  
ATTORNEY TO BE NOTICED

**Defendant**

**Union Technology Int'l (M.C.O.) Co., Ltd.**  
*TERMINATED: 12/21/2010*

represented by **William Taylor Robinson , III**  
Frost Brown Todd LLC  
2200 PNC Center  
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Email: [wrobinson@fbtlaw.com](mailto:wrobinson@fbtlaw.com)  
LEAD ATTORNEY

**Defendant**

**Print-Rite Holdings, Ltd.**  
*TERMINATED: 12/21/2010*

represented by **William Taylor Robinson , III**  
(See above for address)  
LEAD ATTORNEY

**Defendant**

**Copy Technologies, Inc.**  
*TERMINATED: 08/02/2011*

represented by **Charles H. Suh**  
(See above for address)  
LEAD ATTORNEY  
PRO HAC VICE

ATTORNEY TO BE NOTICED

**Michael P Foley**  
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*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Richard L Stroup**  
(See above for address)  
*PRO HAC VICE*  
*ATTORNEY TO BE NOTICED*

**Defendant**

**John Does**  
1-20

represented by **Gregory Frederick Ahrens**  
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*ATTORNEY TO BE NOTICED*

**Defendant**

**Nano Pacific Corporation**  
*TERMINATED: 01/19/2011*

represented by **David Graham Kern**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Gary Hnath**  
(See above for address)  
*PRO HAC VICE*  
*ATTORNEY TO BE NOTICED*

**Jeffrey C Lowe**  
(See above for address)  
*PRO HAC VICE*  
*ATTORNEY TO BE NOTICED*

**Defendant**

**OutOfToner.com**  
*TERMINATED: 09/13/2012*

represented by **William A Nolan**  
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*LEAD ATTORNEY*

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*TERMINATED: 09/13/2012*  
*PRO HAC VICE*

**Defendant**

**IJSS Inc.**  
*TERMINATED: 06/25/2013*

represented by **David Graham Kern**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Stephen Spraul Schmidt**  
(See above for address)  
*ATTORNEY TO BE NOTICED*

**Defendant**

**Blue Trading LLC**

represented by **Glenn Dean Bellamy**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Andre A Gibson**  
Andre Gibson, Chartered  
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*PRO HAC VICE*  
*ATTORNEY TO BE NOTICED*

**Defendant**

**Core Servicios Informaticos S.I.**  
*TERMINATED: 05/30/2014*

represented by **Glenn Dean Bellamy**  
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*LEAD ATTORNEY*  
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**Robert G Schuler**  
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*TERMINATED: 10/30/2013*  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Andre A Gibson**  
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*PRO HAC VICE*  
*ATTORNEY TO BE NOTICED*

**Defendant**

**ECOI US Supplies, Inc.**  
*TERMINATED: 08/13/2013*

**Defendant**

**Eco Service China Ltd.**  
*TERMINATED: 01/08/2014*

represented by **Glenn Dean Bellamy**  
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*LEAD ATTORNEY*  
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**Andre A Gibson**  
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*ATTORNEY TO BE NOTICED*

**Defendant**

**Green Cartridge Company**  
*TERMINATED: 01/08/2014*  
*formerly known as*  
Enviro Green Technologies  
*TERMINATED: 01/08/2014*

**Defendant**

**Exprint International, Inc.**

**Defendant**

**FBA Holding, Inc.**  
*TERMINATED: 11/12/2013*

represented by **James David Liles**  
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**Defendant**

**Fuller International Corporation**  
*TERMINATED: 07/01/2013*

**Defendant**

**Green Imaging Supplies, Inc.**  
*TERMINATED: 05/24/2013*

**Defendant**

**Green Project, Inc.**  
*TERMINATED: 11/12/2013*

represented by **Lena Nadine Bacani**  
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**Defendant**

**Impression Products, Inc.**  
*TERMINATED: 06/24/2014*

represented by **Crystal L Maluchnik**  
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*ATTORNEY TO BE NOTICED*

**Defendant**

**Interseroh Product Cycle GmbH**  
*TERMINATED: 05/30/2014*

represented by **David Graham Kern**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Defendant**

**K &W International Development, Inc.**  
*TERMINATED: 06/19/2013*

**Defendant**

**LD Products, Inc.**

represented by **Karl Stephen Kronenberger**  
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**Marc N Bernstein**  
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*ATTORNEY TO BE NOTICED*

**Defendant**

**N &L Global Co.**  
*TERMINATED: 04/03/2014*

represented by **David Graham Kern**  
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**Andrew B. Chen**  
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Email: [sdang@bluecapitallaw.com](mailto:sdang@bluecapitallaw.com)  
*ATTORNEY TO BE NOTICED*

**Defendant**

**NGS S.A.**  
*TERMINATED: 01/08/2014*

**Defendant**

**Onlinetechstores.com, Inc.**  
*TERMINATED: 03/27/2014*

represented by **David Graham Kern**  
(See above for address)  
**LEAD ATTORNEY**  
**ATTORNEY TO BE NOTICED**

**Defendant**

**Prinko Image Co. (USA)**  
*TERMINATED: 01/08/2014*

**Defendant**

**Printronic Corporation**

**Defendant**

**Recyca BVBA**  
*TERMINATED: 03/27/2014*

represented by **Daniel William Wolff**  
Crowell &Moring  
1001 Pennsylvania Avenue NW  
Washington, DC 20004  
202/624-2621  
Email: [dwolff@crowell.com](mailto:dwolff@crowell.com)  
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**Brian M. Koide**  
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**ATTORNEY TO BE NOTICED**

**Defendant**

**Refiltoner**  
*TERMINATED: 01/08/2014*

**Defendant**

**Shanghai Orink Infotech International Co., Ltd.**  
*TERMINATED: 01/08/2014*

**Defendant**

**Standard Image USA, Inc.**  
*TERMINATED: 09/27/2013*

**Defendant**

**Tech Optics, Inc.**  
*TERMINATED: 04/29/2014*

represented by **David Graham Kern**  
(See above for address)  
**LEAD ATTORNEY**  
**ATTORNEY TO BE NOTICED**

**Defendant**

**Tesen Development (Hong Kong) Co. Ltd.**

**Defendant**

**Wal Group LLC**  
*TERMINATED: 09/27/2013*

represented by **Lena Nadine Bacani**  
(See above for address)

*PRO HAC VICE*

**Thomas Tak-Wah Chan**  
(See above for address)  
*PRO HAC VICE*

**Michael P Foley**  
(See above for address)  
*ATTORNEY TO BE NOTICED*

**Defendant**

**XSE Group, Inc.**  
*TERMINATED: 08/15/2013*

represented by **Steven B Loy**  
(See above for address)

**Defendant**

**Zhuhai Richeng Development Co., Ltd.**  
*TERMINATED: 01/08/2014*

**Defendant**

**MBC Trading, Inc.**  
*TERMINATED: 01/08/2014*

**Defendant**

**Eco Service Sp. z o.o.**  
*TERMINATED: 05/30/2014*

represented by **Andre A Gibson**  
(See above for address)  
*LEAD ATTORNEY*  
*PRO HAC VICE*  
*ATTORNEY TO BE NOTICED*

**Glenn Dean Bellamy**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Defendant**

**Hock Group LLC**  
*TERMINATED: 03/06/2014*

**Defendant**

**LTS Consumables, Inc.**  
*TERMINATED: 01/22/2014*

**Defendant**

**OW Supplies Corp.**  
*TERMINATED: 04/03/2014*

represented by **David Graham Kern**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Defendant**

**Sinotime Technologies, Inc.**  
*TERMINATED: 04/29/2014*

represented by **Jack S. Gatlin**  
Freund Freeze and Arnold  
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Cincinnati, OH 45202  
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**Hongwei Shang**

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**ATTORNEY TO BE NOTICED**

**Defendant**

**TonerLand**  
*TERMINATED: 02/19/2014*

represented by **Michael P Foley**  
(See above for address)  
**LEAD ATTORNEY**  
**ATTORNEY TO BE NOTICED**

**Defendant**

**Zhuhai Aicon Image Co., Ltd.**  
*TERMINATED: 06/23/2014*

**Defendant**

**Benigno Adeva And His Companies**

represented by **Gregory Frederick Ahrens**  
(See above for address)  
**LEAD ATTORNEY**  
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**William E. Thomson**  
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**Counter Claimant**

**Green Project, Inc.**  
*TERMINATED: 11/12/2013*

represented by **Lena Nadine Bacani**  
(See above for address)  
**PRO HAC VICE**

**Thomas Tak-Wah Chan**  
(See above for address)  
**PRO HAC VICE**

**Michael P Foley**  
(See above for address)  
**ATTORNEY TO BE NOTICED**

V.

**Counter Defendant**

**Lexmark International, Inc.**

represented by **P Douglas Barr**  
(See above for address)  
**LEAD ATTORNEY**  
**ATTORNEY TO BE NOTICED**

**Anthony J. Phelps**  
(See above for address)  
**ATTORNEY TO BE NOTICED**

**Audra Carol Eidem Heinze**  
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*ATTORNEY TO BE NOTICED*

**Jason Shull**

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*ATTORNEY TO BE NOTICED*

**Matthew P Becker**

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**Neil C Trueman**

(See above for address)

*TERMINATED: 06/19/2012*

*PRO HAC VICE*

**Steven B Loy**

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**Timothy C Meece**

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**V Bryan Medlock**

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**William J Hunter , Jr.**

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**Counter Claimant**

**Wal Group LLC**

*TERMINATED: 09/27/2013*

represented by **Lena Nadine Bacani**

(See above for address)

*PRO HAC VICE*

**Thomas Tak-Wah Chan**

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**Michael P Foley**

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V.

**Counter Defendant**

**Lexmark International, Inc.**

represented by **P Douglas Barr**

(See above for address)

*LEAD ATTORNEY*

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**Anthony J. Phelps**

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**Audra Carol Eidem Heinze**

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**Jason Shull**

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*ATTORNEY TO BE NOTICED*

**Matthew P Becker**  
(See above for address)  
*ATTORNEY TO BE NOTICED*

**Neil C Trueman**  
(See above for address)  
*TERMINATED: 06/19/2012*  
*PRO HAC VICE*

**Steven B Loy**  
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*ATTORNEY TO BE NOTICED*

**Timothy C Meece**  
(See above for address)  
*ATTORNEY TO BE NOTICED*

**V Bryan Medlock**  
(See above for address)  
*ATTORNEY TO BE NOTICED*

**William J Hunter , Jr.**  
(See above for address)  
*ATTORNEY TO BE NOTICED*

**Counter Claimant**

**N &L Global Co.**  
*TERMINATED: 04/03/2014*

represented by **David Graham Kern**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

V.

**Counter Defendant**

**Lexmark International, Inc.**

represented by **P Douglas Barr**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Anthony J. Phelps**  
(See above for address)  
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**Audra Carol Eidem Heinze**  
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**Jason Shull**  
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**Matthew P Becker**  
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**Neil C Trueman**  
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*TERMINATED: 06/19/2012*  
*PRO HAC VICE*

**Steven B Loy**  
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**Timothy C Meece**  
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**V Bryan Medlock**  
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*ATTORNEY TO BE NOTICED*

**William J Hunter , Jr.**  
(See above for address)  
*ATTORNEY TO BE NOTICED*

**Counter Claimant**

**Onlinetechstores.com, Inc.**  
*TERMINATED: 03/27/2014*

represented by **David Graham Kern**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

V.

**Counter Defendant**

**Lexmark International, Inc.**

represented by **P Douglas Barr**  
(See above for address)  
*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Anthony J. Phelps**  
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*ATTORNEY TO BE NOTICED*

**Audra Carol Eidem Heinze**  
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*ATTORNEY TO BE NOTICED*

**Jason Shull**  
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**Matthew P Becker**  
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**Neil C Trueman**  
(See above for address)  
*TERMINATED: 06/19/2012*

**Steven B Loy**  
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**Timothy C Meece**  
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**V Bryan Medlock**  
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*ATTORNEY TO BE NOTICED*

**William J Hunter , Jr.**  
(See above for address)  
*ATTORNEY TO BE NOTICED*

**Counter Claimant**

**Onlinetechstores.com, Inc.**

represented by **David Graham Kern**  
(See above for address)  
**LEAD ATTORNEY**  
**ATTORNEY TO BE NOTICED**

V.

**Counter Defendant**

**Lexmark International, Inc.**

represented by **P Douglas Barr**  
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**LEAD ATTORNEY**  
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**Anthony J. Phelps**  
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**Jason Shull**  
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**Matthew P Becker**  
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**Neil C Trueman**  
(See above for address)  
**TERMINATED: 06/19/2012**

**Steven B Loy**  
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**Timothy C Meece**  
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**V Bryan Medlock**  
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**William J Hunter , Jr.**  
(See above for address)  
**ATTORNEY TO BE NOTICED**

**Counter Claimant**

**OW Supplies Corp.**  
**TERMINATED: 04/03/2014**

represented by **David Graham Kern**  
(See above for address)  
**LEAD ATTORNEY**  
**ATTORNEY TO BE NOTICED**

V.

**Counter Defendant**

**Lexmark International, Inc.**

represented by **P Douglas Barr**  
(See above for address)



*LEAD ATTORNEY*  
*ATTORNEY TO BE NOTICED*

**Anthony J. Phelps**  
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**Audra Carol Eidem Heinze**  
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**Jason Shull**  
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*ATTORNEY TO BE NOTICED*

**Matthew P Becker**  
 (See above for address)  
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**Neil C Trueman**  
 (See above for address)  
*TERMINATED: 06/19/2012*

**Steven B Loy**  
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**Timothy C Meece**  
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| Date Filed | #        | Docket Text  |
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| 08/20/2010 | <u>1</u> | COMPLAINT with JURY DEMAND against All Defendants, filed by Lexmark International, Inc. (Attachments: # <u>1</u> Exhibit 1, # <u>2</u> Exhibit 2, # <u>3</u> Exhibit 3, # <u>4</u> Exhibit 4, # <u>5</u> Exhibit 5, # <u>6</u> Exhibit 6, # <u>7</u> Exhibit 7, # <u>8</u> Exhibit 8, # <u>9</u> Exhibit 9, # <u>10</u> Exhibit 10, # <u>11</u> Exhibit 11, # <u>12</u> Exhibit 12, # <u>13</u> Exhibit 13, # <u>14</u> Exhibit 14, # <u>15</u> Exhibit 15, # <u>16</u> Exhibit 16, # <u>17</u> Exhibit 17, # <u>18</u> Exhibit 18, # <u>19</u> Exhibit 19, # <u>20</u> Exhibit 20, # <u>21</u> Exhibit 21, # <u>22</u> Civil Cover Sheet, # <u>23</u> Filing Fee Receipt) (jlw) (Entered: 08/20/2010) |
| 08/20/2010 | <u>2</u> | Corporate Disclosure Statement by Plaintiff Lexmark International, Inc. (jlw) (Entered: 08/20/2010)  |
| 08/20/2010 |          | Filing fee: \$ 350.00, receipt number 100CIN009296 (lk1) (Entered: 08/24/2010)   |
| 08/23/2010 | <u>3</u> | Notice by Clerk of Southern District of Ohio of Pro Hac Vice Rules as to Attorney William J. Hunter, Steven B. Loy, Anthony J. Phelps, Timothy C. Meece, V. Bryan Medlock, Matthew P. Becker, Jason S. Shull, Neil C. Trueman (jlw1) (Entered: 08/23/2010)   |
| 08/23/2010 | <u>4</u> | Report on the Filing or Determination of an Action Regarding a Patent or Trademark. (jlw1) (Entered: 08/23/2010)   |
| 08/23/2010 |          | ***If this case is referred, it will be to Magistrate Judge Timothy S. Hogan. (jlw1) (Entered: 08/23/2010)   |

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| 09/07/2010 | <u>5</u>  | Summons Issued as to Nectron International, Inc. (mr1) (Entered: 09/07/2010)   |
| 09/07/2010 | <u>6</u>  | CERTIFICATE of Mailing by Clerk per Local Rule 4 for service. (mr1) (Entered: 09/07/2010)  |
| 09/17/2010 | <u>7</u>  | SUMMONS Returned Executed as to Defendant Nectron International, Inc. (Mario G. Ceste, Esq.) served on 9/14/2010, answer due 10/5/2010. (mr1) (Entered: 09/17/2010)  |
| 09/24/2010 | <u>8</u>  | Summons Issued as to Nano Pacific Corporation, IJSS Inc., Ninestar Image Co., Ltd, Ninestar Image Int'l, Ltd, Ninestar Technology Company, Ltd, Seine Image International Co., Ltd, Ziprint Image Corporation. (jlw1) (Entered: 09/24/2010)  |
| 09/24/2010 | <u>9</u>  | CERTIFICATE of Clerk : Certified mailing of summons and complaint through the Clerk's Office pursuant to Local Rule 4.2 (Attachments: # <u>1</u> Certified Mail Receipt) (jlw1) (Entered: 09/24/2010)  |
| 09/27/2010 | <u>10</u> | Summons Issued as to CRServices, Incorporated, Copy Technologies, Inc., Huizhou Jahwa Electronics Co, Ltd., Jahwa Electronics Co., Ltd., and Laser Toner Technology, Inc. (mr1) (Entered: 09/27/2010)  |
| 09/27/2010 | <u>11</u> | CERTIFICATE of Mailing by Clerk re <u>1</u> Complaint and <u>10</u> Issued Summons for service per Rule 4.2. (mr1) (Entered: 09/27/2010)   |
| 09/27/2010 | <u>12</u> | MOTION for Leave to Appear Pro Hac Vice of Steven B. Loy (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certifications, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 09/27/2010)   |
| 09/27/2010 | <u>13</u> | MOTION for Leave to Appear Pro Hac Vice of William J. Hunter, Jr. (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certifications, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 09/27/2010)  |
| 09/27/2010 | <u>14</u> | MOTION for Leave to Appear Pro Hac Vice of Anthony J. Phelps (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certifications, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 09/27/2010)   |
| 09/27/2010 | <u>15</u> | MOTION for Leave to Appear Pro Hac Vice of Timothy C. Meece (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certificate of Admission, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 09/27/2010)  |
| 09/27/2010 | <u>16</u> | MOTION for Leave to Appear Pro Hac Vice of Jason S. Shull (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certificate of Admission, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 09/27/2010)  |
| 09/27/2010 | <u>17</u> | MOTION for Leave to Appear Pro Hac Vice of Matthew P. Becker (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certificate of Admission, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 09/27/2010)   |
| 09/27/2010 | <u>18</u> | MOTION for Leave to Appear Pro Hac Vice of Neil C. Trueman (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certificate of Admission, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 09/27/2010)   |
| 09/27/2010 | <u>19</u> | MOTION for Leave to Appear Pro Hac Vice of V. Bryan Medlock (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certificate, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 09/27/2010)   |
| 09/29/2010 |           | PHV Filing fee: \$1600.00, receipt number 100CIN009617 RE: Motions for PHV Admission re <u>12</u> Steven B. Loy, <u>13</u> William J. Hunter, Jr., <u>14</u> Anthony J. Phelps, <u>15</u> Timothy C. Meece, <u>16</u> Jason S. Shull, <u>17</u> Matthew P. Becker <u>18</u> Neil C. Trueman and <u>19</u> Bryan Medlock. (mr1) (Entered: 09/29/2010) |
| 09/29/2010 | <u>20</u> | Summons Issued as to Alpha Image Tech, E-Toner Mart, Inc., Virtual Imaging Products, Inc. (jlw1) (Entered: 09/29/2010)   |
| 09/30/2010 | <u>21</u> | SUMMONS Returned Executed as to Defendants Nano Pacific served on 9/26/2010, answer due 10/18/2010; Ninestar Image Int'l, Ltd served on 9/26/2010, answer due 10/18/2010; Ninestar Technology Company, Ltd served on 9/26/2010, answer due 10/18/2010; Seine Image International Co., Ltd served on 9/26/2010,                                       |

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|            |           | answer due 10/18/2010; Ziprint Image Corporation served on 9/26/2010, answer due 10/18/2010. (mr1) (Entered: 09/30/2010)  |
| 10/01/2010 | <u>22</u> | CERTIFICATE of Clerk: Certified mailing of summons and complaint through the Clerk's Office pursuant to Local Rule 4.2. (jlw1) (Entered: 10/01/2010)  |
| 10/01/2010 | <u>23</u> | Summons Issued as to Chung Pal Shin, IJSS Inc., Ink Technologies Printer Supplies, LLC, Quality Cartridges, Inc. (lk1) (Entered: 10/01/2010)  |
| 10/01/2010 | <u>24</u> | CERTIFICATE of Clerk: Certified mailing of summons and complaint through the Clerk's Office pursuant to Local Rule 4.2. (lk1) (Entered: 10/01/2010)   |
| 10/01/2010 | <u>25</u> | SUMMONS Returned Executed as to Defendant Ninestar Image Co., Ltd served on 9/27/2010, answer due 10/18/2010. (mr1) (Entered: 10/01/2010)   |
| 10/04/2010 | <u>26</u> | SUMMONS Returned Executed as to Defendant Ink Technologies Printer Supplies, LLC served on 10/2/2010, answer due 10/25/2010. (mr1) (Entered: 10/04/2010)  |
| 10/05/2010 | <u>27</u> | Summons Issued as to ACM Technologies, Inc., Acecom Inc. – San Antonio, Direct Billing International Incorporated. (jlw) (Entered: 10/05/2010)  |
| 10/05/2010 | <u>28</u> | CERTIFICATE of Clerk: Certified mailing of summons and complaint through the Clerk's Office pursuant to Local Rule 4.2. (jlw) (Entered: 10/05/2010)   |
| 10/05/2010 | <u>29</u> | ORDER granting <u>12</u> Motion for Leave to Appear Pro Hac Vice of Steven Loy; granting <u>13</u> Motion for Leave to Appear Pro Hac Vice of William J. Hunter; granting <u>14</u> Motion for Leave to Appear Pro Hac Vice of Anthony J. Phelps; granting <u>15</u> Motion for Leave to Appear Pro Hac Vice of Timothy C. Meece; granting <u>16</u> Motion for Leave to Appear Pro Hac Vice of Jason Shull; granting <u>17</u> Motion for Leave to Appear Pro Hac Vice of Matthew P. Becker; granting <u>18</u> Motion for Leave to Appear Pro Hac Vice of Neil C. Trueman; and granting <u>19</u> Motion for Leave to Appear Pro Hac Vice of V. Bryan Medlock for Plaintiff. Signed by Judge Michael R. Barrett on 10/5/2010. (ba1) Modified to edit text on 10/7/2010 (mr1). (Entered: 10/05/2010) |
| 10/06/2010 | <u>30</u> | Joint MOTION for Extension of Time to File Answer – new date requested 12/31/2010. to <u>1</u> <i>Complaint for Patent Infringement</i> by Plaintiff Lexmark International, Inc., Defendant Nectron International, Inc. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) Modified to edit text and create link on 10/7/2010 (mr1). (Entered: 10/06/2010)  |
| 10/06/2010 | <u>31</u> | Joint MOTION for Extension of Time to File Answer – new date requested 1/20/2011 to <u>1</u> <i>Complaint for Patent Infringement</i> by Plaintiff Lexmark International, Inc., Defendants Nano Pacific Corporation, Ninestar Image Co., Ltd, Ninestar Image Int'l, Ltd, Ninestar Technology Company, Ltd, Seine Image International Co., Ltd, Ziprint Image Corporation. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) Modified to edit text and create link on 10/7/2010 (mr1). (Entered: 10/06/2010)  |
| 10/12/2010 | <u>32</u> | SUMMONS Returned Executed as to Defendants ACM Technologies, Inc. served on 10/8/2010, answer due 10/29/2010; Direct Billing International Incorporated served on 10/7/2010, answer due 10/28/2010; E-Toner Mart, Inc. served on 10/9/2010, answer due 11/1/2010; IJSS Inc. served on 10/12/2010, answer due 11/2/2010 (green card was unsigned); Virtual Imaging Products, Inc. served on 10/6/2010, answer due 10/27/2010. (mr1) (Entered: 10/12/2010)  |
| 10/12/2010 | <u>33</u> | SUMMONS Returned UNEXECUTED as to Defendant Chung Pal Shin – who was NOT served. The green card was returned, unsigned, in a plastic bag by the US Post Office. A search on the USPS website indicates the status as "Delivered" but this was confirmed to indicate 'delivered' status at the law office, not with the defendant. (mr1) Modified to edit text and remove answer date detail on 10/12/2010 (mr1). (Entered: 10/12/2010)  |
| 10/12/2010 | <u>34</u> | Summons Returned Unexecuted as to Acecom Inc. – San Antonio. Envelope was marked as "Attempted – Not Known. Returned to Sender." (mr1) (Entered: 10/12/2010)  |

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| 10/12/2010 |           | Notice of Correction re: <u>33</u> Summons Returned Executed. Parties please note that service was not executed for Chung Pal Shin. A call was made to counsel's office regarding the matter. Mollie (paralegal) confirmed the envelope was returned to their office without the green card attached and marked "Attempted/Not Known." The Answer date will be removed. (mr1) (Entered: 10/12/2010)  |
| 10/13/2010 | <u>35</u> | Joint MOTION for Extension of Time to File Answer re <u>1</u> Complaint,, New date requested 1/24/2011. by Defendants CRServices, Incorporated, Copy Technologies, Inc., Huizhou Jahwa Electronics Co, Ltd., Jahwa Electronics Co., Ltd., Laser Toner Technology, Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 10/13/2010)  |
| 10/13/2010 | <u>36</u> | ORDER granting <u>31</u> Motion for Extension of Time to Answer Nano Pacific Corporation answer due 1/20/2011; Ninestar Image Co., Ltd answer due 1/20/2011; Ninestar Image Int'l, Ltd answer due 1/20/2011; Ninestar Technology Company, Ltd answer due 1/20/2011; Seine Image International Co., Ltd answer due 1/20/2011; Ziprint Image Corporation answer due 1/20/2011. Signed by Judge Michael R. Barrett on 10/13/2010. (ba1) (Entered: 10/13/2010) |
| 10/13/2010 | <u>37</u> | ORDER granting <u>30</u> Motion for Extension of Time to Answer Nectron International, Inc. answer due 12/31/2010. Signed by Judge Michael R. Barrett on 10/13/2010. (ba1) (Entered: 10/13/2010)   |
| 10/18/2010 | <u>38</u> | Joint MOTION for Extension of Time to File Answer re <u>1</u> Complaint,, New date requested 2/11/2011. by Defendant Ink Technologies Printer Supplies, LLC, Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 10/18/2010)   |
| 10/18/2010 | <u>39</u> | NOTICE of Appearance by David Graham Kern for Defendants Nano Pacific Corporation, Ninestar Image Co., Ltd, Ninestar Image Int'l, Ltd, Ninestar Technology Company, Ltd, Seine Image International Co., Ltd, Ziprint Image Corporation (Kern, David) (Entered: 10/18/2010)   |
| 10/18/2010 | <u>40</u> | Corporate Disclosure Statement by Defendant Ninestar Image Co., Ltd. (Kern, David) (Entered: 10/18/2010)   |
| 10/18/2010 | <u>41</u> | Corporate Disclosure Statement by Defendant Seine Image International Co., Ltd. (Kern, David) (Entered: 10/18/2010)  |
| 10/18/2010 | <u>42</u> | Corporate Disclosure Statement by Defendant Ninestar Image Int'l, Ltd. (Kern, David) (Entered: 10/18/2010)   |
| 10/18/2010 | <u>43</u> | Corporate Disclosure Statement by Defendant Ninestar Technology Company, Ltd. (Kern, David) (Entered: 10/18/2010)  |
| 10/18/2010 | <u>44</u> | Corporate Disclosure Statement by Defendant Nano Pacific Corporation. (Kern, David) (Entered: 10/18/2010)  |
| 10/18/2010 | <u>45</u> | Corporate Disclosure Statement by Defendant Ziprint Image Corporation. (Kern, David) (Entered: 10/18/2010)   |
| 10/18/2010 | <u>46</u> | Unopposed MOTION to Stay by Defendants Nano Pacific Corporation, Ninestar Image Co., Ltd, Ninestar Image Int'l, Ltd, Ninestar Technology Company, Ltd, Seine Image International Co., Ltd, Ziprint Image Corporation. (Kern, David) (Entered: 10/18/2010)  |
| 10/21/2010 | <u>47</u> | RESPONSE to Motion re <u>46</u> Unopposed MOTION to Stay filed by Plaintiff Lexmark International, Inc.. (Loy, Steven) (Entered: 10/21/2010)   |
| 10/21/2010 | <u>48</u> | Unopposed MOTION to Stay <i>Proceedings Pursuant to 28 U.S.C Section 1659 Special Appearance of Counsel with all Rights Reserved to Challenge Personal Jurisdiction of Defendants</i> by Defendants CRServices, Incorporated, Copy Technologies, Inc., Huizhou Jahwa Electronics Co, Ltd., Jahwa Electronics Co., Ltd., Laser Toner Technology, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Foley, Michael) (Entered: 10/21/2010)              |
| 10/22/2010 | <u>49</u> | ORDER granting <u>35</u> Motion for Extension of Time to Answer. Defendants Copy Technologies, Inc., Jahwa Electronics Co., Ltd., Huizhou Jahwa Electronics Co., Ltf., Laser Toner Technology, Inc. and CRServices, Incorporated have up to and  |



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|            |           | including January 24, 2011 to file a responsive pleading re: <u>1</u> Complaint. Signed by Judge Michael R. Barrett on 10/19/10. (mr1) Modified to correct date within entry on 11/17/2010 (mr1). (Entered: 10/22/2010)  |
| 10/22/2010 | <u>50</u> | ORDER granting <u>38</u> Motion for Extension of Time to Answer. Ink Technologies Printer Supplies, LLC shall up to and including February 11, 2011 to file a responsive pleading re: <u>1</u> Complaint. Signed by Judge Michael R. Barrett on 10/19/10. (mr1) (Entered: 10/22/2010)  |
| 10/25/2010 | <u>51</u> | Summons Returned Unexecuted as to Quality Cartridges, Inc. (Michael Brecher). Green card was returned unsigned to the Clerk's office. The US Post Office Track & Confirm online Search Results indicated the item was delivered to Lexington, KY. A call was made to counsel to confirm that the package was returned to their office and that service was not complete. (mr1) Modified to remove PDF and upload corrected version on 10/25/2010 (mr1). (mr1). (Entered: 10/25/2010)                               |
| 10/25/2010 |           | Notice of Correction re: <u>51</u> Summons Returned Unexecuted. Parties please be aware that the card was attached to an unrelated document (due to recycling paper efforts) when scanned and inadvertently was included with the scan. Apologies for any confusion caused. The scan was re-docketed without the 2nd page. (mr1) (Entered: 10/25/2010)   |
| 10/25/2010 | <u>52</u> | RESPONSE to Motion re <u>48</u> Unopposed MOTION to Stay <i>Proceedings Pursuant to 28 U.S.C Section 1659 Special Appearance of Counsel with all Rights Reserved to Challenge Personal Jurisdiction of Defendants</i> filed by Plaintiff Lexmark International, Inc.. (Loy, Steven) (Entered: 10/25/2010)  |
| 10/27/2010 | <u>53</u> | Joint MOTION for Extension of Time to File Answer re <u>1</u> Complaint,, New date requested 1/20/2011. by Defendants ACM Technologies, Inc., Direct Billing International Incorporated, IJSS Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 10/27/2010)  |
| 10/27/2010 | <u>54</u> | Joint MOTION for Extension of Time to File Answer re <u>1</u> Complaint,, New date requested 11/10/2010. by Plaintiff Lexmark International, Inc., Defendant Virtual Imaging Products, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 10/27/2010)  |
| 10/29/2010 | <u>55</u> | ORDER granting <u>53</u> Motion for Extension of Time to Answer re <u>1</u> Complaint; ACM Technologies, Inc. answer due 1/20/2011; Direct Billing International Incorporated answer due 1/20/2011; IJSS Inc. answer due 1/20/2011. Signed by Judge Michael R. Barrett on 10/29/2010. (ba1) (Entered: 10/29/2010)  |
| 10/29/2010 | <u>56</u> | ORDER granting <u>54</u> Motion for Extension of Time to Answer re <u>1</u> Complaint; Virtual Imaging Products, Inc. answer due 11/10/2010. Signed by Judge Michael R. Barrett on 10/29/2010. (ba1) (Entered: 10/29/2010)   |
| 11/01/2010 |           | NOTICE of Status Conference re <u>48</u> Unopposed MOTION to Stay <i>Proceedings</i> and <u>46</u> Unopposed MOTION to Stay : Status Conference set for 11/9/2010 at 08:45 AM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 8:45 am; Plaintiff is responsible for notifying opposing parties yet to appear of the date/time of this setting. (ba1) Modified docket text on 11/2/2010 (eh1). (Entered: 11/01/2010) |
| 11/01/2010 | <u>57</u> | MOTION for Leave to Appear Pro Hac Vice of Gary M. Hnath by Defendants Nano Pacific Corporation, Ninestar Image Co., Ltd, Ninestar Image Int'l, Ltd, Ninestar Technology Company, Ltd, Seine Image International Co., Ltd, Ziprint Image Corporation. (Attachments: # <u>1</u> Exhibit Hnath Certificate of Good Standing) (Kern, David) Modified docket text on 11/2/2010 (eh1). (Entered: 11/01/2010)  |
| 11/01/2010 | <u>58</u> | MOTION for Leave to Appear Pro Hac Vice of Jeffery C. Lowe by Defendants Nano Pacific Corporation, Ninestar Image Co., Ltd, Ninestar Image Int'l, Ltd, Ninestar Technology Company, Ltd, Seine Image International Co., Ltd, Ziprint Image Corporation. (Attachments: # <u>1</u> Exhibit Lowe Certificate of Good Standing) (Kern, David) Modified docket text on 11/2/2010 (eh1). (Entered: 11/01/2010)   |
| 11/02/2010 | <u>59</u> | NOTICE of Compliance by Plaintiff Lexmark International, Inc. re Notice of Hearing on Motion, (Attachments: # <u>1</u> Exhibit A - 11/2/10 Letter) (Loy, Steven)   |

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|            |           | Modified docket text on 11/3/2010 (eh1). (Entered: 11/02/2010)   |
| 11/04/2010 | <u>60</u> | ALIAS Summons Issued as to Quality Cartridges, Inc. (jlw1) (Entered: 11/04/2010)   |
| 11/04/2010 | <u>61</u> | Unopposed MOTION to Stay <i>Pursuant to 28 USC 1659</i> by Defendant Virtual Imaging Products, Inc.. (Bellamy, Glenn) (Entered: 11/04/2010)  |
| 11/04/2010 | <u>62</u> | Corporate Disclosure Statement by Defendant Virtual Imaging Products, Inc.. (Bellamy, Glenn) (Entered: 11/04/2010)   |
| 11/04/2010 | <u>63</u> | CERTIFICATE of Clerk: Certified mailing of ALIAS summons and complaint through the Clerk's Office pursuant to Local Rule 4.2. (jlw1) (Entered: 11/04/2010)   |
| 11/05/2010 | <u>64</u> | RESPONSE to Motion re <u>61</u> Unopposed MOTION to Stay <i>Pursuant to 28 USC 1659</i> filed by Plaintiff Lexmark International, Inc.. (Loy, Steven) (Entered: 11/05/2010)  |
| 11/05/2010 | <u>65</u> | Joint MOTION for Extension of Time to File Answer re <u>1</u> Complaint,, New date requested 1/20/2011. by Plaintiff Lexmark International, Inc., Defendant Quality Cartridges, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 11/05/2010)   |
| 11/08/2010 | <u>66</u> | MOTION for Leave to Appear Pro Hac Vice of Richard L. Stroup (Filing fee \$ 200, receipt number 0648-2865150) by Defendants CRServices, Incorporated, Copy Technologies, Inc., Huizhou Jahwa Electronics Co, Ltd., Jahwa Electronics Co., Ltd., Laser Toner Technology, Inc.. (Attachments: # <u>1</u> Exhibit 1 Richard L. Stroup Certificate of Good Standing) (Foley, Michael) (Entered: 11/08/2010)  |
| 11/08/2010 |           | PHV Filing fee: \$400.00, receipt number 100CIN009982 re: <u>57</u> Motion for PHV Admission for Gary M. Hnath and <u>58</u> Motion for PHV Admission for Jeffery C. Lowe. (mr1) (Entered: 11/08/2010)   |
| 11/08/2010 | <u>67</u> | Joint MOTION for Extension of Time to File Answer re <u>1</u> Complaint,, New date requested 1/20/2011. by Defendants Acecom Inc. – San Antonio, Chung Pal Shin, Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 11/08/2010)   |
| 11/09/2010 |           | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference re: <u>46</u> , <u>48</u> , and <u>61</u> Motions to Stay held on 11/9/2010; Douglas Barr, Steven Loy, Bryan Medlock, and Jamie Underwood appeared for Plaintiff; David Shough, David Kern, Jeffrey Lowe, Michael Foley, Richard Stroup, Gary Hnath, Merit Blakeslee, and Mario Ceste appeared for Defendants; motions to stay to be granted; Plaintiff's Counsel to circulate an agreed order and provide to the court for signature; orally granting <u>57</u> , <u>58</u> , and <u>66</u> Motions PHV for Gary Hnath, Jeffery Lowe and Richard Stroup; finding as moot orally <u>65</u> and <u>67</u> Motions for Extension of time; Court's order to follow regarding stay. (ba1) (Entered: 11/09/2010) |
| 11/09/2010 | <u>68</u> | ALIAS Summons Issued as to Acecom Inc. – San Antonio. (mr1) (Entered: 11/09/2010)  |
| 11/09/2010 | <u>69</u> | CERTIFICATE of Mailing by Clerk regarding <u>1</u> Complaint and <u>68</u> Alias Summons for Acecom Inc. – San Antonio. (mr1) (Entered: 11/09/2010)  |
| 11/10/2010 | <u>70</u> | SUMMONS Returned Executed as to Defendant Quality Cartridges, Inc.. Quality Cartridges, Inc. served on 11/8/2010, answer due 11/29/2010. (sct) (Entered: 11/10/2010)   |
| 11/15/2010 | <u>71</u> | ALIAS Summons Issued as to Chung Pal Shin. (jlw1) (Entered: 11/15/2010)  |
| 11/15/2010 | <u>74</u> | CERTIFICATE of Mailing by Mailing by Clerk regarding <u>1</u> Complaint and <u>68</u> Alias Summons for Chung Pal Shin. (jlw1) (Entered: 11/29/2010)   |
| 11/17/2010 |           | Notice of Correction re: <u>49</u> Order on Motion for Extension of Time to Answer. PARTIES please be aware that because the docket entry contained a typographical error with regard to the date, the entry has been edited to reflect the corrected year of 2011. The date of January 24, 2011, as specified in the Order, remains the same. No further action is required. (mr1) (Entered: 11/17/2010)  |

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| 11/18/2010 | <u>72</u> | MOTION for Leave to Appear Pro Hac Vice of Charles H. Suh (Filing fee \$ 200, receipt number 0648-2882069) by Defendants CRServices, Incorporated, Copy Technologies, Inc., Huizhou Jahwa Electronics Co, Ltd., Jahwa Electronics Co., Ltd., Laser Toner Technology, Inc.. (Attachments: # <u>1</u> Exhibit (1) Certificate of Good Standing of Charles H. Suh) (Foley, Michael) (Entered: 11/18/2010) |
| 11/18/2010 | <u>73</u> | SUMMONS Returned Executed as to Defendant Acecom Inc. – San Antonio (thru Gary M. Hnath re: <u>68</u> Alias Summons and <u>69</u> Certificate of Mailing) served on 11/15/2010, answer due 12/6/2010. (mr1) (Entered: 11/18/2010)  |
| 11/29/2010 | <u>75</u> | SUMMONS Returned Executed as to Defendant Chung Pal Shin (thru Gary Hnath re: <u>71</u> Alias Summons and <u>74</u> Certificate of Mailing) served on 11/17/2010, answer due 12/8/2010. Green card was unsigned however a search on the US Post Office website at 'Track and Confirm' indicates the item was delivered on 11/17/10 in Washington, DC 20006. (mr1) (Entered: 11/29/2010)                |
| 11/29/2010 | <u>76</u> | ORDER granting <u>46</u> Motion to Stay; granting <u>48</u> Motion to Stay; granting <u>61</u> Motion to Stay – parties will contact the Court to set a status conference 30 days following a final determination in the ITC investigation. Signed by Judge Michael R. Barrett on 11/29/10. (ba1) (Entered: 11/29/2010)  |
| 11/29/2010 | <u>77</u> | NOTICE of Appearance by David Graham Kern for Defendants Acecom Inc. – San Antonio, Chung Pal Shin, Quality Cartridges, Inc. (Kern, David) (Entered: 11/29/2010)   |
| 11/29/2010 | <u>78</u> | Corporate Disclosure Statement by Defendant Acecom Inc. – San Antonio. (Kern, David) (Entered: 11/29/2010)   |
| 11/29/2010 | <u>79</u> | Corporate Disclosure Statement by Defendant Quality Cartridges, Inc.. (Kern, David) (Entered: 11/29/2010)  |
| 11/29/2010 | <u>80</u> | Corporate Disclosure Statement by Defendant Chung Pal Shin. (Kern, David) (Entered: 11/29/2010)  |
| 11/30/2010 | <u>81</u> | NOTICE by Defendants CRServices, Incorporated, Copy Technologies, Inc., Huizhou Jahwa Electronics Co, Ltd., Jahwa Electronics Co., Ltd., Laser Toner Technology, Inc. re <u>72</u> MOTION for Leave to Appear Pro Hac Vice of Charles H. Suh (Filing fee \$ 200, receipt number 0648-2882069) (Attachments: # <u>1</u> Exhibit Certificate of Good Standing) (Foley, Michael) (Entered: 11/30/2010)    |
| 12/01/2010 | <u>82</u> | ORDER granting <u>72</u> Motion for Leave to Appear Pro Hac Vice of Charles H. Shu for Defendants Jahwa Electronics Co., Ltd; Huizhou Jahwa Electronics Co., Ltd; Laser Toner Technology, Inc.; CRServices; and Copy Technologies, Inc. Signed by Judge Michael R. Barrett on 11/30/10. (ba1) (Entered: 12/01/2010)  |
| 12/06/2010 | <u>83</u> | NOTICE of Appearance by William Taylor Robinson, III for Defendants Print-Rite Holdings, Ltd., Union Technology Int'l (M.C.O.) Co., Ltd. (Robinson, William) (Entered: 12/06/2010)   |
| 12/08/2010 | <u>84</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice by Plaintiff Lexmark International, Inc., Defendant Virtual Imaging Products, Inc.. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal With Prejudice) (Loy, Steven) (Entered: 12/08/2010)   |
| 12/09/2010 | <u>85</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to Virtual Imaging Products, Inc. Signed by Judge Michael R. Barrett on 12/9/10. (mr1) (Entered: 12/09/2010)  |
| 12/14/2010 | <u>86</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc., Defendants Print-Rite Holdings, Ltd., Union Technology Int'l (M.C.O.) Co., Ltd.. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 12/14/2010)          |
| 12/21/2010 | <u>87</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE AND ORDER re Print-Rite Holdings, Ltd. and Union Technology Int'l (M.C.O.) Co., Ltd; Print-Rite Holdings, Ltd. and Union Technology Int'l (M.C.O.) Co., Ltd. terminated. Signed by Judge Michael R.  |

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|            |           | Barrett on 12/20/10. (ba1) (Entered: 12/21/2010)   |
| 01/10/2011 | <u>88</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc., Defendant Nectron International, Inc.. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 01/10/2011)  |
| 01/10/2011 | <u>89</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Defendants Alpha Image Tech, E-Toner Mart, Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 01/10/2011)  |
| 01/11/2011 | <u>90</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE re Defendant Nectron International, Inc. Signed by Judge Michael R. Barrett on 1/11/11. (eh1) (Entered: 01/11/2011)  |
| 01/11/2011 | <u>91</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE re Alpha Image International, Inc. and E-Toner Mart, Inc. Signed by Judge Michael R. Barrett on 1/11/11. (eh1) (Entered: 01/11/2011)   |
| 01/18/2011 | <u>92</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc., Defendants Nano Pacific Corporation, Ninestar Image Co., Ltd, Ninestar Image Int'l, Ltd, Ninestar Technology Company, Ltd, Seine Image International Co., Ltd, Ziprint Image Corporation. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 01/18/2011) |
| 01/19/2011 | <u>93</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to defendants Ninestar Image Co., Ltd; Ninestar Image Int'l, Ltd; Seine Image Int'l Co., Ltd; Ninestar Technology Co., Ltd.; Ziprint Image Corp; and Nano Pacific Corp. Signed by Judge Michael R. Barrett on 1/19/11. (ba1) (Entered: 01/19/2011)  |
| 03/17/2011 | <u>94</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice by Defendant Acecom Inc. – San Antonio, Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 03/17/2011)   |
| 03/17/2011 | <u>95</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice by Defendant Chung Pal Shin, Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 03/17/2011)  |
| 03/21/2011 | <u>96</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to defendant Acecom, Inc. Signed by Judge Michael R. Barrett on 3/18/11. (eh1) (Entered: 03/21/2011)  |
| 03/21/2011 | <u>97</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to defendant Chung Pal Shin (d/b/a Ink Master). Signed by Judge Michael R. Barrett on 3/18/11. (eh1) (Entered: 03/21/2011)  |
| 04/06/2011 | <u>98</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Defendant Ink Technologies Printer Supplies, LLC, Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice) (Loy, Steven) (Entered: 04/06/2011)  |
| 04/11/2011 | <u>99</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice by Defendant IJSS Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 04/11/2011)   |



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|            |            | 04/11/2011)   |
| 04/14/2011 | <u>100</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to defendant Ink Technologies Printer Supplies, LLC. Signed by Judge Michael R. Barrett on 4/7/11. (eh1) Modified to correct signature date on 4/15/2011 (lk1). (Entered: 04/14/2011)  |
| 04/14/2011 | <u>101</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to defendant IJSS Inc. Signed by Judge Michael R. Barrett on 4/12/11. (eh1) Modified to correct signature date on 4/15/2011 (lk1). (Entered: 04/14/2011)   |
| 07/28/2011 | <u>102</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Defendants CRServices, Incorporated, Copy Technologies, Inc., Huizhou Jahwa Electronics Co, Ltd., Jahwa Electronics Co., Ltd., Laser Toner Technology, Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction and Dismissal with Prejudice) (Loy, Steven) (Entered: 07/28/2011)  |
| 08/02/2011 | <u>103</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to defendants Jahwa Electronics Co., Ltd., Huizhou Jahwa Electronics Co., Ltd., Laser Toner Technology, Copy Technologies, and CRServices Incorporated. Signed by Judge Michael R. Barrett on 7/29/11. (eh1) (Entered: 08/02/2011)   |
| 09/14/2011 | <u>104</u> | Joint MOTION Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Defendant Direct Billing International Incorporated, Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 09/14/2011)   |
| 09/15/2011 | <u>105</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to defendant Direct Billing International Incorporated. Signed by Judge Michael R. Barrett on 9/14/11. (eh1) (Entered: 09/15/2011)   |
| 10/11/2011 |            | NOTICE of Hearing: Please be aware that a Status Conference is set for 10/31/2011 at 10:00 AM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 10:00 am. (ba1) (Entered: 10/11/2011)  |
| 10/31/2011 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 10/31/2011; Steven Loy and Timothy Meece appeared for Defendant; stay to be lifted; Plaintiff's to commence identifying John Does; a follow up Status Conference is set for 1/31/2012 at 09:30 AM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 9:30 am; Court's order to following regarding stay. (ba1) (Entered: 10/31/2011) |
| 11/01/2011 | <u>106</u> | MOTION for Protective Order by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Proposed Protective Order) (Loy, Steven) (Entered: 11/01/2011)   |
| 11/03/2011 | <u>107</u> | ORDER lifting <u>76</u> Order on Motion to Stay; a status conference is set by telephone for 1/31/12 at 9:30 am; parties are reminded to initiate contact with the Court by calling 513-564-7660 five minutes prior to 9:30 am. Signed by Judge Michael R. Barrett on 11/3/11. (ba1) (Entered: 11/03/2011)  |
| 11/03/2011 | <u>108</u> | MOTION for Extension of Time New date requested 3/2/2012. to Serve "John Doe" Defendants by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Stewart v. Tennessee Valley Auth., # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 11/03/2011)   |
| 11/10/2011 | <u>109</u> | ORDER signed by Judge Michael R. Barrett granting <u>108</u> Motion for Extension of Time. Plaintiff Lexmark shall have until 3/2/2012, within which to identify and serve the "John Doe" Defendants. (eh1) (Entered: 11/10/2011)   |
| 11/14/2011 | <u>110</u> | NOTICE of Appearance by David Graham Kern for Defendant ACM Technologies, Inc. (Kern, David) (Entered: 11/14/2011)  |

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| 11/14/2011 | <u>111</u> | Corporate Disclosure Statement by Defendant ACM Technologies, Inc.. (Kern, David) (Entered: 11/14/2011)  |
| 11/15/2011 | <u>112</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Defendant ACM Technologies, Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 11/15/2011)   |
| 11/15/2011 | <u>113</u> | NOTICE by Defendant ACM Technologies, Inc., Plaintiff Lexmark International, Inc. of <i>Confession of Judgment</i> (Loy, Steven) (Entered: 11/15/2011)   |
| 11/17/2011 | <u>114</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to ACM Technologies granting <u>112</u> Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice filed by ACM Technologies, Inc., Lexmark International, Inc. Signed by Judge Michael R. Barrett on 11/17/11. (ba1) (Entered: 11/17/2011)   |
| 11/21/2011 | <u>115</u> | MOTION for Issuance of Letters Rogatory by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ontario Evidence Act, # <u>2</u> Exhibit A – Greentec International Inc. Letter Rogatory, # <u>3</u> Exhibit B – Article, # <u>4</u> Text of Proposed Order) (Loy, Steven) (Entered: 11/21/2011)  |
| 11/23/2011 | <u>116</u> | ORDER granting <u>115</u> Motion for Issuance of Letters Rogatory. Signed by Judge Michael R. Barrett on 11/23/11. (ba1) (Entered: 11/23/2011)   |
| 12/02/2011 | <u>117</u> | PROTECTIVE ORDER. Signed by Judge Michael R. Barrett on 12/2/11. (ba1) (Entered: 12/02/2011)   |
| 01/31/2012 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 1/31/2012; Matthew Becker and Steven Loy appeared for Plaintiff; David Kern appeared for Defendant; Plaintiff continues to work on identifying remaining John Doe Defendants; an oral request is granted regarding Service for an extension through and including 6/1/2012; a follow up Status Conference is set for 6/1/2012 at 09:30 AM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 9:30 am. (ba1) (Entered: 01/31/2012) |
| 05/25/2012 | <u>118</u> | MOTION for Extension of Time New date requested 8/30/2012. <i>to Extend the Deadline to Serve "John Doe" Defendants</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – March 22, 2012 Order, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 05/25/2012)  |
| 05/29/2012 |            | NOTICE of Hearing: Please be aware that the Status Conference set for 6/1/12 is RESET to 6/7/2012 at 01:30 PM and remains set by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 1:30 pm. (ba1) (Entered: 05/29/2012)  |
| 05/31/2012 | <u>119</u> | ORDER granting <u>118</u> Motion for Extension of Time to serve John Does; Lexmark shall have an additional 90 days through and including 8/30/12 within which to identify and serve the John Doe defendants. Signed by Judge Michael R. Barrett on 5/31/12. (ba1) (Entered: 05/31/2012)   |
| 06/07/2012 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 6/7/2012; Jason Shull, Steven Loy and Timothy Meece appeared for Plaintiff; David Kern, Jeffrey Lowe, Max Moskovitz and John Hocanson appeared for Defendants; parties continue to identify John Does and will keep the Court informed as matters are resolved. (ba1) Modified typo on 6/8/2012 (mtw). (Entered: 06/07/2012)  |
| 06/18/2012 | <u>120</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1. Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 06/18/2012)   |
| 06/18/2012 | <u>121</u> | NOTICE by Plaintiff Lexmark International, Inc. of <i>Withdrawal of Co-Counsel Neil C. Trueman</i> (Loy, Steven) (Entered: 06/18/2012)   |

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| 06/20/2012 | <u>122</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to John Doe Defendant Tonercharge granting <u>120</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 6/19/12. (ba1) (Entered: 06/20/2012)   |
| 06/25/2012 | <u>123</u> | MOTION for Entry of Stipluated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1. Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) Modified on 8/3/2012 (ba1). (Entered: 06/25/2012)   |
| 06/25/2012 | <u>124</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1. Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) Modified on 8/3/2012 (ba1). (Entered: 06/25/2012)  |
| 06/28/2012 | <u>125</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1. Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) Modified on 8/3/2012 (ba1). (Entered: 06/28/2012)   |
| 06/28/2012 | <u>126</u> | Motion for Contempt and Memorandum in Support for <i>IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A. Order, # <u>2</u> Exhibit B. Joint Motion, # <u>3</u> Exhibit C. Gardner Declaration, # <u>4</u> Exhibit D. Reinholtz Declaration Part I, # <u>5</u> Exhibit D. Reinholtz Declaration Part II, # <u>6</u> Exhibit D. Reinholtz Declaration Part III, # <u>7</u> Exhibit D. Reinholtz Declaration Part IV, # <u>8</u> Exhibit D. Reinholtz Declaration Part V, # <u>9</u> Exhibit E. Shull to Kidde Email, # <u>10</u> Exhibit F. Filed Under Seal Pursuant to Protective Order, # <u>11</u> Text of Proposed Order) (Loy, Steven) (Entered: 06/28/2012) |
| 07/05/2012 | <u>128</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Image Solutions</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) Modified on 8/3/2012 (ba1). (Entered: 07/05/2012)  |
| 07/08/2012 | <u>129</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to John Doe Defendant K G Toner–Nu, Inc. Signed by Judge Michael R. Barrett on 7/6/12. (ba1) (Entered: 07/08/2012)   |
| 07/08/2012 | <u>130</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to John Doe Defendant enhanced Laser Products. Signed by Judge Michael R. Barrett on 7/8/12. (ba1) (Entered: 07/08/2012)   |
| 07/08/2012 | <u>131</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to John Doe Defendant Quality Printing. Signed by Judge Michael R. Barrett on 7/6/12. (ba1) (Entered: 07/08/2012)  |
| 07/08/2012 | <u>132</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to John Doe Defendant Image Solutions. Signed by Judge Michael R. Barrett on 7/6/12. (ba1) (Entered: 07/08/2012)   |
| 07/09/2012 | <u>133</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Imex America Corporation</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) Modified on 8/3/2012 (ba1). (Entered: 07/09/2012)   |
| 07/11/2012 | <u>134</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT AND DISMISSAL WITH PREJUDICE of John Doe Defendant Imex America Corporation. Signed by Judge Michael R. Barrett on 7/10/12. (ba1) (Entered: 07/11/2012)   |

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| 07/17/2012 | <u>135</u> | MOTION for Extension of Time to File Response/Reply as to <u>126</u> Motion for Contempt and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order New date requested 9/7/2012. by Defendant IJSS Inc.. (Attachments: # <u>1</u> Text of Proposed Order Proposed Order Granting Motion, # <u>2</u> Affidavit Affidavit of Jon E. Hokanson and Exhibits) (Kern, David) (Entered: 07/17/2012)   |
| 07/19/2012 | <u>136</u> | MOTION for Leave to Appear Pro Hac Vice of Jon E. Hokanson; Thomas S. Kidde (Filing fee \$ 400) by Defendant IJSS Inc.. (Attachments: # <u>1</u> Exhibit Certificate of Good Standing for Jon E. Hokanson, # <u>2</u> Exhibit Certificate of Good Standing for Thomas S. Kidde, # <u>3</u> Text of Proposed Order Proposed Order Granting Pro Hac Vice Admission) (Kern, David) (Additional attachment(s) added on 7/19/2012: # <u>4</u> Filing Fee Receipt) (eh1). (Entered: 07/19/2012)                                      |
| 07/19/2012 |            | Filing fee: \$ 400.00, receipt number 100CIN015856 re <u>136</u> MOTION for Leave to Appear Pro Hac Vice of Jon E. Hokanson; Thomas S. Kidde. (eh1) (Entered: 07/19/2012)  |
| 07/20/2012 |            | NOTICE of Status Conference on Motion re <u>135</u> MOTION for Extension of Time to File Response/Reply as to <u>126</u> Motion for Contempt and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order; Please be aware that a status conference is set for 7/24/2012 at 02:30 PM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 2:30 pm. (ba1) (Entered: 07/20/2012) |
| 07/20/2012 | <u>137</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Alltech Cartridges</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 07/20/2012)  |
| 07/24/2012 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 7/24/2012; parties request additional time regarding <u>135</u> Motion for Extension of time to file a response to which the court finds reasonable; therefore a follow up Status Conference is set for 8/7/2012 at 10:30 AM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 10:30 am. (ba1) (Entered: 07/24/2012)                 |
| 07/25/2012 | <u>138</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Imageprint Technologies, Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 07/25/2012)   |
| 07/25/2012 | <u>139</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>All Color Imaging</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 07/25/2012)   |
| 07/25/2012 | <u>140</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>National Copy Cartridge, Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 07/25/2012)   |
| 07/25/2012 | <u>141</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Laser Recharge, Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 07/25/2012)  |
| 07/25/2012 | <u>142</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Carrco Imaging</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy,  |



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|            |            | Steven) (Entered: 07/25/2012)   |
| 07/27/2012 |            | NOTICE of Hearing: Please be aware that the follow up Status Conference set for 8/7/2012 at 10:30 am is being RESET IN TIME ONLY from 10:30 am to 03:00 PM and will remain set by teleconference before Judge Michael R. Barrett; parties are reminded to initiate contact with the Court by calling 513-564-7660 five minutes prior to 3:00 pm. (ba1) (Entered: 07/27/2012)                      |
| 07/27/2012 | <u>143</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>American Laser Products Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 07/27/2012)                 |
| 07/27/2012 | <u>144</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Imaging Products Inc. d/b/a Laser Image Plus</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 07/27/2012) |
| 07/30/2012 | <u>145</u> | NOTICE by Defendant IJSS Inc. re <u>136</u> MOTION for Leave to Appear Pro Hac Vice of Jon E. Hokanson; Thomas S. Kidde (Filing fee \$ 400) <i>Supplemental Certificates</i> (Kern, David) (Entered: 07/30/2012)  |
| 07/30/2012 | <u>146</u> | CONSENT JUDGMENT granting <u>137</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Alltech Cartridges</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 7/30/12. (ba1) (Entered: 07/30/2012)   |
| 07/30/2012 | <u>147</u> | CONSENT JUDGMENT granting <u>138</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Imageprint Technologies, Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 7/30/12. (ba1) (Entered: 07/30/2012)  |
| 07/30/2012 | <u>148</u> | CONSENT JUDGMENT granting <u>139</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>All Color Imaging</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 7/30/12. (ba1) (Entered: 07/30/2012)  |
| 07/30/2012 | <u>149</u> | CONSENT JUDGMENT granting <u>140</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>National Copy Cartridge, Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 7/30/12. (ba1) (Entered: 07/30/2012)  |
| 07/30/2012 | <u>150</u> | CONSENT JUDGMENT granting <u>141</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Laser Recharge, Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 7/30/12. (ba1) (Entered: 07/30/2012)   |
| 07/30/2012 | <u>151</u> | CONSENT JUDGMENT granting <u>142</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Carrco Imaging</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 7/30/12. (ba1) (Entered: 07/30/2012)   |
| 08/01/2012 | <u>152</u> | CONSENT JUDGMENT granting <u>143</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>American Laser Products Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 7/31/12. (ba1) (Entered: 08/01/2012)   |
| 08/01/2012 | <u>153</u> | CONSENT JUDGMENT granting <u>144</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Imaging Products Inc. d/b/a Laser Image Plus</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/1/12. (ba1) (Entered: 08/01/2012)  |
| 08/01/2012 | <u>154</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice ( <i>Laser Kare Tech Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order)   |

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|            |            | (Loy, Steven) (Entered: 08/01/2012)   |
| 08/02/2012 | <u>155</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Photikon Corporation</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/02/2012)   |
| 08/02/2012 | <u>156</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Superior Recharger Systems Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/02/2012)  |
| 08/06/2012 | <u>157</u> | CONSENT JUDGMENT granting <u>154</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice ( <i>Laser Kare Tech Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/6/12. (ba1) (Entered: 08/06/2012)  |
| 08/06/2012 | <u>158</u> | CONSENT JUDGMENT granting <u>155</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Photikon Corporation</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/6/12. (ba1) (Entered: 08/06/2012)  |
| 08/06/2012 | <u>159</u> | CONSENT JUDGMENT granting <u>156</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Superior Recharger Systems Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/6/12. (ba1) (Entered: 08/06/2012)   |
| 08/07/2012 | <u>160</u> | ORDER granting <u>136</u> Motion for Leave to Appear Pro Hac Vice of Jon E. Hokanson and Thomas S. Kidde for John Doe Defendants IJSS, Inc., d/b/a TonerZone.com and Inkjet Superstore.com. Signed by Judge Michael R. Barrett on 8/7/12. (ba1) (Entered: 08/07/2012)   |
| 08/07/2012 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 8/7/2012; Anthony Phelps and Timothy Meece appeared for Plaintiff; David Kern and Jon Hokanson appeared for Defendant regarding parties <u>135</u> Motion for Extension of time to file a response re <u>126</u> Motion for Contempt; parties are working on resolving their issues; a follow up Status Conference is set for 8/15/2012 at 03:00 PM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 3:00 pm. (ba1) Modified on 8/7/2012 (ba1) to edit the text. (Entered: 08/07/2012) |
| 08/08/2012 | <u>161</u> | MOTION Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/08/2012)  |
| 08/10/2012 | <u>162</u> | MOTION For Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1– Stipulated Permanent Injunction, Consent, Judgment and Dismissal With Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/10/2012)  |
| 08/13/2012 | <u>163</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Master Print Supplies</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/13/2012)  |
| 08/13/2012 | <u>164</u> | CONSENT JUDGMENT granting <u>161</u> MOTION Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/13/12. (ba1) (Entered: 08/13/2012)   |
| 08/13/2012 | <u>165</u> | NOTICE of Appearance by William A Nolan for Defendant OutOfToner.com (Nolan, William) (Entered: 08/13/2012)   |

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| 08/13/2012 | <u>166</u> | MOTION for Leave to Appear Pro Hac Vice of Ian R. Walsworth (Filing fee \$ 200, receipt number 0648-3759304) by Defendant OutOfToner.com. (Attachments: # <u>1</u> Certificate of Good Standing) (Nolan, William) (Entered: 08/13/2012)   |
| 08/14/2012 | <u>167</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Data Supply LLC</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/14/2012)  |
| 08/14/2012 | <u>168</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>MB Sales</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/14/2012)   |
| 08/14/2012 | <u>169</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Toner Supplies, Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/14/2012)   |
| 08/14/2012 | <u>170</u> | MOTION for Extension of Time New date requested 11/28/2012. ( <i>to Serve "John Doe" Defendants</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/14/2012)  |
| 08/15/2012 |            | NOTICE of Hearing: Please be aware that the Status Conference set for 8/15/12 at 3:00 pm is RESET to 8/16/2012 at 01:00 PM and remains set by teleconference before Judge Michael R. Barrett; the parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 1:00 pm. (ba1) (Entered: 08/15/2012)  |
| 08/15/2012 | <u>171</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Primedia Products</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/15/2012)  |
| 08/16/2012 |            | Minute Order. Proceedings held before Judge Michael R. Barrett: Status Conference held on 8/16/2012; Stephen Loy appeared for Plaintiff; Jon Hokanson appeared for Defendant IJSS, Inc.; parties agree they require additional time for experts; the Court orally grants <u>170</u> Motion for Extension of Time to Serve John Does until 11/28/12; a follow up Status Conference is set for 8/30/2012 at 12:00 PM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 12:00 pm. (ba1) (Entered: 08/16/2012) |
| 08/17/2012 | <u>172</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>U.S. Print &amp; Toner d/b/a National Copy Cartridge</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/17/2012)   |
| 08/17/2012 | <u>173</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Wal Group LLC</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/17/2012)  |
| 08/20/2012 | <u>174</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc., Defendant OutOfToner.com. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Loy, Steven) (Entered: 08/20/2012)  |
| 08/21/2012 | <u>175</u> | ORDER granting <u>166</u> Motion for Leave to Appear Pro Hac Vice of Ian R. Walsworth for Defendant OutOfToner.com. Signed by Judge Michael R. Barrett on 8/17/12. (ba1) (Entered: 08/21/2012)  |

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| 08/22/2012 | <u>176</u> | CONSENT JUDGMENT granting <u>163</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Master Print Supplies</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/22/12. (ba1) (Entered: 08/22/2012)  |
| 08/22/2012 | <u>177</u> | CONSENT JUDGMENT granting <u>167</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Data Supply LLC</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/22/12. (ba1) (Entered: 08/22/2012)  |
| 08/22/2012 | <u>178</u> | CONSENT JUDGMENT granting <u>168</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>MB Sales</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/22/12. (ba1) (Entered: 08/22/2012)   |
| 08/22/2012 | <u>179</u> | CONSENT JUDGMENT granting <u>169</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Toner Supplies, Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/22/12. (ba1) (Entered: 08/22/2012)   |
| 08/22/2012 | <u>180</u> | CONSENT JUDGMENT granting <u>171</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Primedia Products</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/22/12. (ba1) (Entered: 08/22/2012)  |
| 08/22/2012 | <u>181</u> | CONSENT JUDGMENT granting <u>162</u> MOTION For Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/22/12. (ba1) (Entered: 08/22/2012)   |
| 08/24/2012 | <u>182</u> | MOTION for Entry of Stipulated Permanent Injunction and Dismissal with Prejudice ( <i>Tri State Distribution, Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/24/2012)  |
| 08/27/2012 | <u>183</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Marlo Products d/b/a Toner Man</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/27/2012)   |
| 08/28/2012 | <u>184</u> | CONSENT JUDGMENT granting <u>172</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>U.S. Print &amp; Toner d/b/a National Copy Cartridge</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/27/12. (ba1) (Entered: 08/28/2012)   |
| 08/28/2012 | <u>185</u> | CONSENT JUDGMENT granting <u>173</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Wal Group LLC</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/27/12. (ba1) (Entered: 08/28/2012)  |
| 08/30/2012 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 8/30/2012; Steven Loy appeared for Plaintiff; David Kern appeared for Defendant Quality Cartridge; Jon Hokanson and Thomas Kidde appeared for Defendant IJSS; parties agree that responses re <u>126</u> Motion for Contempt and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order are due by 9/24/2012; reply deadline will be set following depositions; parties to initiate contact with the Court to set that deadline. (ba1) (Entered: 08/30/2012) |
| 08/30/2012 | <u>186</u> | NOTICE by Plaintiff Lexmark International, Inc. re <u>126</u> Motion for Contempt and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order (of Filing Corrected Declaration of Andrew Gardner) (Attachments: # <u>1</u> Corrected Declaration of Andrew Gardner) (Loy, Steven) (Entered: 08/30/2012)  |
| 08/31/2012 | <u>187</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>QSP Technologies, LLC</i> ) by Plaintiff Lexmark  |



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|            |            | International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 08/31/2012)  |
| 09/04/2012 | <u>188</u> | CONSENT JUDGMENT granting <u>183</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Marlo Products d/b/a Toner Man</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 9/4/12. (ba1) (Entered: 09/04/2012)   |
| 09/04/2012 | <u>189</u> | CONSENT JUDGMENT granting <u>182</u> MOTION for Entry of Stipulated Permanent Injunction and Dismissal with Prejudice ( <i>Tri State Distribution, Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 9/4/12. (ba1) (Entered: 09/04/2012)   |
| 09/04/2012 | <u>190</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Tech Optics</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 09/04/2012)                       |
| 09/10/2012 | <u>191</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Optimum Value Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 09/10/2012)                |
| 09/12/2012 | <u>192</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Magnified Imaging Solutions, Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 09/12/2012) |
| 09/12/2012 | <u>193</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Printing Technology, Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 09/12/2012)         |
| 09/13/2012 | <u>194</u> | CONSENT JUDGMENT granting <u>187</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>QSP Technologies, LLC</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 9/13/12. (ba1) (Entered: 09/13/2012)   |
| 09/13/2012 | <u>195</u> | CONSENT JUDGMENT granting <u>190</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Tech Optics</i> ) filed by Lexmark International, Inc.. Signed by Judge Michael R. Barrett on 9/13/12. (ba1) (Entered: 09/13/2012)  |
| 09/13/2012 | <u>196</u> | CONSENT JUDGMENT granting <u>174</u> Joint MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice filed by OutOfToner.com, Lexmark International, Inc. Signed by Judge Michael R. Barrett on 9/13/12. (ba1) (Entered: 09/13/2012)  |
| 09/18/2012 | <u>197</u> | MOTION for Extension of Time to File Response/Reply as to <u>126</u> Motion for Contempt and Memorandum in Support for <i>IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> New date requested 11/26/2012. by Defendant IJSS Inc.. (Attachments: # <u>1</u> Exhibit Correspondence) (Kern, David) (Entered: 09/18/2012)                         |
| 09/19/2012 | <u>198</u> | RESPONSE in Opposition re <u>197</u> MOTION for Extension of Time to File Response/Reply as to <u>126</u> Motion for Contempt and Memorandum in Support for <i>IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> New date requested 11/26/2012. < filed by Plaintiff Lexmark International, Inc.. (Loy, Steven) (Entered: 09/19/2012)           |
| 09/21/2012 |            | NOTICE of Status Conference on Motion re <u>197</u> MOTION for Extension of Time to File Response/Reply as to <u>126</u> Motion for Contempt and Memorandum in Support for <i>IJSS to be Held in Contempt for Violation of this Court's Permanent</i>  |

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|            |            | <i>Injunction Order</i> ; Please be aware that a status conference is set for 9/25/2012 at 02:00 PM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 2:00 pm. (ba1) (Entered: 09/21/2012)  |
| 09/25/2012 | <u>199</u> | CONSENT JUDGMENT granting <u>191</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Optimum Value Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 9/25/12. (ba1) (Entered: 09/25/2012)  |
| 09/25/2012 | <u>200</u> | CONSENT JUDGMENT granting <u>192</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Magnified Imaging Solutions, Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 9/25/12. (ba1) (Entered: 09/25/2012)   |
| 09/25/2012 | <u>201</u> | CONSENT JUDGMENT granting <u>193</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Printing Technology, Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 9/25/12. (ba1) (Entered: 09/25/2012)   |
| 09/25/2012 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 9/25/2012 re <u>197</u> Motion for Extension of Time to respond to <u>126</u> Motion for Contempt; Jason Shull and Steven Loy appeared for Plaintiff; David Kern, Jon Hokanson and Thomas Kidde appeared for Defendant IJSS; briefing stay on <u>197</u> Motion for Extension of Time for the Court to review the filing and set a follow up conference if necessary. (ba1) Modified on 9/26/2012 (ba1) to edit text. (Entered: 09/25/2012) |
| 10/11/2012 | <u>202</u> | ORDER granting a 14-day extention re <u>197</u> Motion for Extension of Time to File Response/Reply re <u>126</u> Motion for Contempt. Signed by Judge Michael R. Barrett on 10/11/12. (ba1) (Entered: 10/11/2012)   |
| 10/15/2012 | <u>203</u> | MOTION for Leave to Appear Pro Hac Vice of Audra Carol Eidem Heinze (Filing fee \$ 200) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Certificate of Admission to the Bar of Illinois, # <u>2</u> Text of Proposed Order) (Barr, P) (Entered: 10/15/2012)   |
| 10/18/2012 |            | PHV Filing fee re <u>203</u> MOTION for Leave to Appear Pro Hac Vice of Audra Carol Eidem Heinze: \$ 200, receipt number 100CIN016695 (mee) Modified to clarify docket text and link to motion on 10/19/2012 (mtw). (Entered: 10/18/2012)  |
| 10/25/2012 | <u>204</u> | Objection re <u>186</u> Notice (Other), <i>Evidentiary Objections to Corrected Declaration of Andrew Gardner</i> by Defendant IJSS Inc.. (Attachments: # <u>1</u> Exhibit) (Kern, David) (Entered: 10/25/2012)   |
| 10/25/2012 | <u>205</u> | RESPONSE in Opposition re <u>126</u> Motion for Contempt <i>and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> filed by Defendant IJSS Inc.. (Attachments: # <u>1</u> Affidavit Affidavit of Ilan Douek, # <u>2</u> Affidavit Declaration of Thomas S. Kidde, # <u>3</u> Affidavit Declaration of Stephen Sherman) (Kern, David) (Entered: 10/25/2012)   |
| 10/29/2012 | <u>206</u> | ORDER granting <u>203</u> Motion for Leave to Appear Pro Hac Vice of Audra Carol Eidem Heinze for Plaintiff. Signed by Judge Michael R. Barrett on 10/26/12. (ba1) (Entered: 10/29/2012)   |
| 11/05/2012 | <u>207</u> | Unopposed MOTION for Entry of Agreed Order Extending Lexmark's Time to File a Reply in Support of Its Motion for IJSS to Be Held in Contempt for Violation of This Court's Permanent Injunction Order re <u>126</u> Motion for Contempt <i>and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 11/05/2012)   |
| 11/07/2012 | <u>208</u> | ORDER granting <u>207</u> Motion extending Lexmark's time to file a reply in support of <u>126</u> Motion for ISJJ to be held in contempt for violation of this Court's permanent injunction order until Lexmark can conduct necessary depositions. Signed by Judge Michael R. Barrett on 11/7/12. (ba1) (Entered: 11/07/2012)   |

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| 11/08/2012 | <u>209</u> | MOTION for Extension of Time to Serve "John Doe" Defendants. New date requested 2/4/2013 by Plaintiff Lexmark International, Inc. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) Modified to clarify docket text on 11/9/2012 (mee). (Entered: 11/08/2012)  |
| 11/27/2012 | <u>210</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Business Express</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 11/27/2012)   |
| 11/28/2012 | <u>211</u> | ORDER granting <u>209</u> Motion for Extension of Time: The Court being otherwise sufficiently advised hereby ORDERS that Lexmark's Motion to Extend the Deadline is GRANTED. Lexmark shall have an additional 90 days, through and including February 4, 2013, within which to identify and to serve the "John Doe" Defendants.. Signed by Judge Michael R. Barrett on 11/28/2012. (jlw) (Entered: 11/28/2012)   |
| 12/03/2012 | <u>212</u> | CONSENT JUDGMENT granting <u>210</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Business Express</i> ) filed by Lexmark International, Inc... Signed by Judge Michael R. Barrett on 12/3/12. (ba1) (Entered: 12/03/2012)   |
| 12/10/2012 | <u>213</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Fanelli Boys, Inc.</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Loy, Steven) (Entered: 12/10/2012)   |
| 12/20/2012 | <u>214</u> | CONSENT JUDGMENT granting <u>213</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice ( <i>Fanelli Boys, Inc.</i> ) filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 12/19/12. (ba1) (Entered: 12/20/2012)  |
| 12/20/2012 | <u>215</u> | Motion for Contempt ( <i>for Ink Technologies to Be Held in Contempt for Violation of This Court's Permanent Injunction Order</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – Stipulated Permanent Injunction, Consent Judgment, and Dismissal With Prejudice, # <u>3</u> Exhibit B – Joint Motion for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice, # <u>4</u> Exhibit C – Declaration of Gardner, # <u>5</u> Exhibit D – Declaration of Reinholtz, Part. 1, # <u>6</u> Exhibit D – Declaration of Reinholtz, Part 2, # <u>7</u> Exhibit D – Declaration of Reinholtz, Part 3, # <u>8</u> Exhibit D – Declaration of Reinholtz, Part 4, # <u>9</u> Exhibit E – Order 26, # <u>10</u> Text of Proposed Order) (Loy, Steven) (Entered: 12/20/2012) |
| 01/04/2013 | <u>216</u> | Unopposed MOTION for Extension of Time to File Response/Reply as to <u>215</u> Motion for Contempt ( <i>for Ink Technologies to Be Held in Contempt for Violation of This Court's Permanent Injunction Order</i> ) New date requested 2/4/2013. by Defendant Ink Technologies Printer Supplies, LLC. (Attachments: # <u>1</u> Text of Proposed Order) (Shough, David) (Entered: 01/04/2013)   |
| 01/11/2013 | <u>217</u> | NOTICE by Defendant IJSS Inc. re <u>205</u> Response in Opposition to Motion, <i>Notice of Filing of Declaration of Dennis Stover</i> (Attachments: # <u>1</u> Exhibit Declaration of Dennis Stover) (Kern, David) (Entered: 01/11/2013)  |
| 01/22/2013 | <u>218</u> | MOTION for Extension of Time New date requested 5/6/2013. <i>to Extend the Deadline to Serve "John Doe" Defendants</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 01/22/2013)   |
| 01/23/2013 | <u>219</u> | ORDER granting <u>216</u> Motion for Extension of Time to File Response/Reply re <u>215</u> Motion for Contempt ( <i>for Ink Technologies to Be Held in Contempt for Violation of This Court's Permanent Injunction Order</i> ) ; Responses due by 2/4/2013. Signed by Judge Michael R. Barrett on 1/22/13. (ba1) (Entered: 01/23/2013)   |
| 01/31/2013 | <u>220</u> | ORDER granting <u>218</u> Motion for Extension of Time to Serve John Doe Defendants until 5/6/13. Signed by Judge Michael R. Barrett on 1/31/13. (ba1) (Entered: 01/31/2013)  |

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| 01/31/2013 | <u>221</u> | Second MOTION for Extension of Time to File Response/Reply as to <u>215</u> Motion for Contempt ( <i>for Ink Technologies to Be Held in Contempt for Violation of This Court's Permanent Injunction Order</i> ) New date requested 2/11/2013. by Defendant Ink Technologies Printer Supplies, LLC. (Attachments: # <u>1</u> Text of Proposed Order) (Shough, David) (Entered: 01/31/2013)   |
| 02/11/2013 | <u>222</u> | Third MOTION for Extension of Time to File Response/Reply as to <u>215</u> Motion for Contempt ( <i>for Ink Technologies to Be Held in Contempt for Violation of This Court's Permanent Injunction Order</i> ) New date requested 2/19/2013. by Defendant Ink Technologies Printer Supplies, LLC. (Attachments: # <u>1</u> Text of Proposed Order) (Shough, David) (Entered: 02/11/2013)  |
| 02/12/2013 | <u>223</u> | ORDER granting <u>222</u> Motion for Extension of Time to File Response/Reply re <u>215</u> Motion for Contempt ( <i>for Ink Technologies to Be Held in Contempt for Violation of This Court's Permanent Injunction Order</i> ); Responses due by 2/19/2013. Signed by Judge Michael R. Barrett on 2/12/13. (ba1) (Entered: 02/12/2013)   |
| 02/26/2013 | <u>224</u> | Joint MOTION for Entry of Stipulated Entry Granting Motion for Contempt re <u>215</u> Motion for Contempt ( <i>for Ink Technologies to Be Held in Contempt for Violation of This Court's Permanent Injunction Order</i> ) by Defendant Ink Technologies Printer Supplies, LLC, Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Stipulated Entry Granting Motion for Contempt) (Loy, Steven) (Entered: 02/26/2013)   |
| 02/28/2013 | <u>225</u> | REPLY to Response to Motion re <u>126</u> Motion for Contempt <i>and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Reinholtz Transcript, # <u>2</u> Exhibit B – Sherman Transcript, # <u>3</u> Exhibit C – Order 26, # <u>4</u> Exhibit D – Douek Transcript, # <u>5</u> Exhibit E – Filed under seal pursuant to protective order, # <u>6</u> Exhibit F – Filed under seal pursuant to protective order, # <u>7</u> Exhibit G – Filed under seal pursuant to protective order, # <u>8</u> Exhibit H – Photographs of IJSS 13 and IJSS 17, # <u>9</u> Exhibit I – Second Declaration of Andrew Gardner) (Loy, Steven) (Entered: 02/28/2013) |
| 03/04/2013 | <u>227</u> | STIPULATED ENTRY granting <u>215</u> Motion for Contempt. Signed by Judge Michael R. Barrett on 3/1/13. (ba1) (Entered: 03/04/2013)   |
| 03/22/2013 | <u>228</u> | MOTION for Leave to File <i>Surreply in Opposition to Lexmark's Motion for Contempt</i> by Defendant IJSS Inc.. (Attachments: # <u>1</u> Exhibit Proposed Sur–Reply of IJSS, Inc., # <u>2</u> Affidavit Declaration of Thomas S. Kidde, # <u>3</u> Affidavit Declaration of Stephen Sherman) (Kern, David) (Additional attachment(s) added on 3/25/2013: # <u>4</u> Notice, # <u>5</u> Exhibit A to the Declaration of Thomas S. Kidde) (tt). (Entered: 03/22/2013)   |
| 03/26/2013 | <u>229</u> | RESPONSE in Opposition re <u>228</u> MOTION for Leave to File <i>Surreply in Opposition to Lexmark's <u>126</u> Motion for Contempt for Violation of This Court's Permanent Injunction Order</i> filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Ninestar Petition, # <u>2</u> Exhibit B – Supreme Court Denial of Petition) (Loy, Steven) Modified on 4/18/2013 (ba1) to add link to original motion. (Entered: 03/26/2013)   |
| 03/28/2013 | <u>230</u> | ORDER finding as moot <u>135</u> Motion for Extension of Time to File Response/Reply. Signed by Judge Michael R. Barrett on 3/28/13. (ba1) (Entered: 03/28/2013)  |
| 03/29/2013 |            | NOTICE of Status Conference re <u>126</u> Motion for Contempt <i>and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> ; Please be aware that a Status Conference is set for 4/17/2013 at 10:00 AM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513–564–7660 five minutes prior to 10:00 am (ba1) (Entered: 03/29/2013)   |
| 04/05/2013 | <u>231</u> | ORDER granting <u>228</u> Motion for Leave to File Sur–reply re <u>126</u> Motion for Contempt; sur–reply due 7 days of the entry of this Order; parties are reminded the of the status conference set 4/17/13 at 10:00 am. Signed by Judge Michael R. Barrett on 4/4/13. (ba1) (Entered: 04/05/2013)   |



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| 04/17/2013 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 4/17/2013; Timothy Meece, Jason Shull, Steven Loy and Bryan Medlock appeared for Plaintiff; David Kern, Thomas Kidde and Jon Hokanson appeared for IJSS; the Court will follow up with the parties regarding an evidentiary hearing to be set 6/17–19/2013 and as to technology in the courtroom; Parties are notified that they are responsible for separately filing the sur–reply to their motion for contempt as attached to <u>228</u> Motion for Leave. (ba1) Modified on 4/18/2013 (ba1) to edit text and regenerate NEF. (Entered: 04/17/2013)  |
| 04/18/2013 | <u>232</u> | Supplemental Memorandum Opposing re <u>126</u> Motion for Contempt <i>and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> , <u>228</u> MOTION for Leave to File <i>Surreply in Opposition to Lexmark's Motion for Contempt Sur–Reply</i> filed by Defendant IJSS Inc.. (Attachments: # <u>1</u> Affidavit Declaration of Thomas S. Kidde, # <u>2</u> Affidavit Supplemental Declaration of Stephen Sherman) (Kern, David) (Entered: 04/18/2013)   |
| 04/19/2013 |            | NOTICE of Hearing on Motion re <u>126</u> Motion for Contempt <i>and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> ; Please be aware that an Evidentiary Hearing is set for 6/17/2013–6/19/2013 beginning at 09:30 AM in Courtroom 109 – Cincinnati before Judge Michael R. Barrett. (ba1) (Entered: 04/19/2013)  |
| 04/22/2013 | <u>233</u> | AMENDED COMPLAINT ( <i>First</i> ) for Patent Infringement against Direct Billing International Incorporated, IJSS Inc., Blue Trading LLC, Core Servicios Informaticos S.I., ECOI US Supplies, Inc., Eco Service China Ltd., Enviro Green Technologies, Exprint International, Inc., FBA Holding, Inc., Fuller International Corporation, Green Imaging Supplies, Inc., Green Project, Inc., Impression Products, Inc., Interseroh Product Cycle GmbH, K &W International Development, Inc., LD Products, Inc., N &L Global Co., NGS S.A., Onlinetechstores.com, Inc., Prinko Image Co. (USA), Printronic Corporation, Recyca BVBA, Refilterner, Shanghai Orink Infotech International Co., Ltd., Standard Image USA, Inc., Tech Optics, Inc., Tesen Development (Hong Kong) Co. Ltd., Wal Group LLC, XSE Group, Inc., Zhuhai Richeng Development Co., Ltd., MBC Trading, Inc., filed by Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – 9/27/11 Final Determination, # <u>2</u> Exhibit 2 – General Exclusion Order, # <u>3</u> Exhibit 3 – Laser Printer Models Chart, # <u>4</u> Exhibit 4 – '032 Patent, # <u>5</u> Exhibit 5 – '169 Patent, # <u>6</u> Exhibit 6 – '231 Patent, # <u>7</u> Exhibit 7 – '233 Patent, # <u>8</u> Exhibit 8 – '661 Patent, # <u>9</u> Exhibit 9 – '432 Patent, # <u>10</u> Exhibit 10 – '378 Patent, # <u>11</u> Exhibit 11 – '772 Patent, # <u>12</u> Exhibit 12 – '291 Patent, # <u>13</u> Exhibit 13 – '771 Patent, # <u>14</u> Exhibit 14 – '015 Patent, # <u>15</u> Exhibit 15 – '876 Patent, # <u>16</u> Exhibit 16 – '383 Patent, # <u>17</u> Exhibit 17 – '662 Patent, # <u>18</u> Exhibit 18 – '489 Patent, # <u>19</u> Exhibit 19 – '692 Patent, # <u>20</u> Exhibit 20 – '031 Patent, # <u>21</u> Exhibit 21 – '792 Patent, # <u>22</u> Exhibit 22 – '510 Patent, # <u>23</u> Exhibit 23 – '760 Patent, # <u>24</u> Exhibit 24 – '204 Patent) (Loy, Steven) (Entered: 04/22/2013) |
| 04/23/2013 | <u>234</u> | NOTICE by Plaintiff Lexmark International, Inc. of Service of Requests to "John Doe" Defendants to Waive Service of a Summons, Pursuant to Fed. R. Civ. P. 4(d) (Loy, Steven) (Entered: 04/23/2013)  |
| 05/01/2013 | <u>235</u> | NOTICE of Appearance by Glenn Dean Bellamy for Defendant Blue Trading LLC (Bellamy, Glenn) (Entered: 05/01/2013)   |
| 05/01/2013 | <u>236</u> | Corporate Disclosure Statement by Defendant Blue Trading LLC. (Bellamy, Glenn) (Entered: 05/01/2013)   |
| 05/01/2013 | <u>237</u> | MOTION for Leave to Appear Pro Hac Vice of Andre A. Gibson (Filing fee \$ 200, receipt number 0648–4086552) by Defendant Blue Trading LLC. (Attachments: # <u>1</u> Certificate of Good Standing, # <u>2</u> Text of Proposed Order) (Bellamy, Glenn) (Entered: 05/01/2013)  |
| 05/02/2013 | <u>238</u> | MOTION for Extension of Time New date requested 9/13/2013. ( <i>of the Deadline to Serve Defendants</i> ) by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 05/02/2013)   |
| 05/02/2013 | <u>239</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Blue Trading LLC on 4/26/2013, answer due 6/25/2013. (Loy, Steven) (Entered: 05/02/2013)   |

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| 05/02/2013 | <u>240</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to FBA Holding, Inc. on 4/23/2013, answer due 6/24/2013. (Loy, Steven) (Entered: 05/02/2013)   |
| 05/06/2013 | <u>241</u> | ORDER granting <u>237</u> Motion for Leave to Appear Pro Hac Vice of Andre A. Gibson for Defendant Blue Trading, LLC. Signed by Judge Michael R. Barrett on 5/3/13. (ba1) (Entered: 05/06/2013)                                     |
| 05/06/2013 | <u>242</u> | MOTION to Strike <i>Lexmark's First Amended Complaint</i> by Defendant IJSS Inc.. (Kern, David) (Entered: 05/06/2013)   |
| 05/10/2013 | <u>243</u> | ORDER granting <u>238</u> Motion for Extension of Time to Serve Defendants through and including 9/3/13. Signed by Judge Michael R. Barrett on 5/9/13. (ba1) (Entered: 05/10/2013)  |
| 05/13/2013 | <u>244</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Green Project, Inc. on 4/23/2013, answer due 6/24/2013. (Loy, Steven) (Entered: 05/13/2013)   |
| 05/13/2013 | <u>245</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Wal Group LLC on 4/23/2013, answer due 6/24/2013. (Loy, Steven) (Entered: 05/13/2013)   |
| 05/14/2013 | <u>246</u> | RESPONSE in Opposition re <u>242</u> MOTION to Strike <i>Lexmark's First Amended Complaint</i> filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 05/14/2013) |
| 05/14/2013 | <u>247</u> | MOTION for Leave to Amend the Complaint by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 05/14/2013)  |
| 05/23/2013 | <u>248</u> | Unopposed MOTION for Leave to File Excess Pages by Defendant Blue Trading LLC. (Attachments: # <u>1</u> Text of Proposed Order) (Gibson, Andre) (Entered: 05/23/2013)   |
| 05/23/2013 | <u>249</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to XSE Group, Inc. on 4/23/2013, answer due 6/24/2013. (Eidem Heinze, Audra) (Entered: 05/23/2013)   |
| 05/23/2013 | <u>250</u> | NOTICE of Voluntary Dismissal by Plaintiff Lexmark International, Inc. (Loy, Steven) (Entered: 05/23/2013)  |
| 05/23/2013 | <u>251</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Printronic Corporation on 4/23/2013, answer due 6/24/2013. (Eidem Heinze, Audra) (Entered: 05/23/2013)  |
| 05/28/2013 | <u>252</u> | ORDER granting <u>248</u> Motion for Leave to File Excess Pages. Signed by Judge Michael R. Barrett on 5/24/13. (ba1) (Entered: 05/28/2013)   |
| 05/28/2013 | <u>253</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Fuller International Corporation on 4/23/2013, answer due 6/24/2013. (Eidem Heinze, Audra) (Entered: 05/28/2013)  |
| 05/28/2013 | <u>254</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to LD Products, Inc. on 4/23/2013, answer due 6/24/2013. (Eidem Heinze, Audra) (Entered: 05/28/2013)   |
| 05/28/2013 | <u>255</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Prinko Image Co. (USA) on 4/23/2013, answer due 6/24/2013. (Eidem Heinze, Audra) (Entered: 05/28/2013)  |
| 05/28/2013 | <u>256</u> | REPLY to Response to Motion re <u>242</u> MOTION to Strike <i>Lexmark's First Amended Complaint</i> filed by Defendant IJSS Inc.. (Schmidt, Stephen) (Entered: 05/28/2013)  |
| 05/28/2013 | <u>257</u> | RESPONSE in Opposition re <u>247</u> MOTION for Leave to Amend the Complaint filed by Defendant IJSS Inc.. (Schmidt, Stephen) (Entered: 05/28/2013)   |
| 05/29/2013 | <u>258</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Standard Image USA, Inc. on 4/23/2013, answer due 6/24/2013. (Eidem Heinze, Audra) (Entered: 05/29/2013)  |
| 05/31/2013 | <u>259</u> | MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM , MOTION to Dismiss for Lack of Jurisdiction ( Responses due by 6/24/2013), MOTION to Change Venue by Defendant Blue Trading LLC. (Attachments: # <u>1</u> Exhibit 1 –               |

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|            |            | Declaration of Alfredo Alvarado, # <u>2</u> Exhibit 2 – Invoices of Sales – North Canton, # <u>3</u> Exhibit 3 – Invoices of Sales – Mansfield, # <u>4</u> Exhibit Declaration of Mike Detrow, # <u>5</u> Exhibit 5 – 2012 Patent Litigation Efficiency Study, # <u>6</u> Exhibit 6 – Copy of Pages from Blue Trading's Website) (Gibson, Andre) (Entered: 05/31/2013) |
| 06/04/2013 | <u>260</u> | REPLY to Response to Motion re <u>247</u> MOTION for Leave to Amend the Complaint filed by Plaintiff Lexmark International, Inc.. (Loy, Steven) (Entered: 06/04/2013)  |
| 06/06/2013 | <u>261</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Direct Billing International Incorporated on 4/23/2013, answer due 6/24/2013. (Eidem Heinze, Audra) (Entered: 06/06/2013)  |
| 06/06/2013 | <u>262</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to Onlinetechstores.com, Inc. on 5/6/2013, answer due 7/5/2013. (Eidem Heinze, Audra) (Entered: 06/06/2013)   |
| 06/11/2013 | <u>263</u> | Unopposed MOTION for Extension of Time New date requested 7/8/2013. <i>to Respond to Defendant Blue Trading's Motion to Dismiss</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 06/11/2013)   |
| 06/11/2013 | <u>264</u> | MOTION for Permanent Injunction , <i>Consent Judgment, and Dismissal with Prejudice</i> by Plaintiff Lexmark International, Inc.. Responses due by 7/5/2013 (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 06/11/2013)       |
| 06/11/2013 | <u>265</u> | MOTION for Permanent Injunction , <i>Consent Judgment, and Dismissal with Prejudice</i> by Plaintiff Lexmark International, Inc.. Responses due by 7/5/2013 (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice, # <u>2</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 06/11/2013)       |
| 06/14/2013 | <u>267</u> | NOTICE by Plaintiff Lexmark International, Inc. re <u>259</u> MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM MOTION to Dismiss for Lack of Jurisdiction MOTION to Change Venue ( <i>Notice of Authority</i> ) (Attachments: # <u>1</u> Exhibit A – Order Granting Motion to Transfer) (Loy, Steven) (Entered: 06/14/2013)  |
| 06/14/2013 | <u>269</u> | NOTICE by Defendant IJSS Inc. <i>of Filing Depositions Under Seal</i> (Schmidt, Stephen) (Entered: 06/14/2013)   |
| 06/17/2013 | <u>270</u> | NOTICE by Plaintiff Lexmark International, Inc. <i>of Filing Depositions Under Seal</i> (Loy, Steven) (Entered: 06/17/2013)  |
| 06/17/2013 | <u>271</u> | Exhibit List ( <i>Hearing</i> ) by Defendant IJSS Inc., Plaintiff Lexmark International, Inc... (Loy, Steven) (Entered: 06/17/2013)  |
| 06/17/2013 | <u>278</u> | Joint MOTION for Extension of Time New date requested 8/21/2013. <i>to Respond to Complaint for Patent Infringement</i> by Defendant LD Products, Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 06/17/2013)  |
| 06/17/2013 | <u>279</u> | Minute Entry for proceedings held before Judge Michael R. Barrett: Motion Hearing held on 6/17/2013 re <u>126</u> Motion for Contempt filed by Lexmark International, Inc; Counsel present; arguments/witness testimony; parties to provide the Court with an entry. (Court Reporter Maryann Maffia, Official.) (ba1) (Entered: 06/17/2013)                            |
| 06/19/2013 | <u>280</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT AND DISMISSAL WITH PREJUDICE granting <u>264</u> MOTION for Permanent Injunction , <i>Consent Judgment, and Dismissal with Prejudice</i> filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 6/18/13. (ba1) (Entered: 06/19/2013)   |

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| 06/19/2013 | <u>281</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE granting <u>265</u> MOTION for Permanent Injunction, <i>Consent Judgment, and Dismissal with Prejudice</i> filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 6/18/13. (ba1) (Entered: 06/19/2013)  |
| 06/19/2013 | <u>282</u> | ORDER granting <u>263</u> Motion for Extension of Time to file a response re <u>259</u> Motion to Dismiss filed by Defendant Blue Trading up to and including 7/8/13. Signed by Judge Michael R. Barrett on 6/18/13. (ba1) (Entered: 06/19/2013)  |
| 06/19/2013 | <u>283</u> | Joint MOTION Entry of Stipulated Order for Contempt re <u>126</u> Motion for Contempt <i>and Memorandum in Support for IJSS to be Held in Contempt for Violation of this Court's Permanent Injunction Order</i> by Defendant IJSS Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit Stipulated Order for Contempt) (Shull, Jason) (Entered: 06/19/2013) |
| 06/19/2013 | <u>284</u> | Joint MOTION Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice by Defendant IJSS Inc., Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit Stipulated Permanent Injunction, Consent Judgment, and Dismissal With Prejudice) (Shull, Jason) (Entered: 06/19/2013)   |
| 06/20/2013 | <u>285</u> | Response re <u>267</u> Notice (Other), by Defendant Blue Trading LLC. (Gibson, Andre) (Entered: 06/20/2013)   |
| 06/21/2013 | <u>286</u> | WAIVER OF SERVICE Returned Executed. Waiver sent to N & L Global Co. on 4/23/2013, answer due 6/24/2013. (Eidem Heinze, Audra) (Entered: 06/21/2013)  |
| 06/21/2013 | <u>287</u> | ORDER granting <u>278</u> Joint MOTION for Extension of Time to Answer <u>233</u> Amended Complaint filed by Lexmark International, Inc. against LD Products, Inc.; answer due 8/21/2013. Signed by Judge Michael R. Barrett on 6/21/13. (ba1) (Entered: 06/21/2013)  |
| 06/21/2013 | <u>288</u> | Joint MOTION for Extension of Time New date requested 8/23/2013. <i>(to Respond to Complaint for Patent Infringement)</i> by Plaintiff Lexmark International, Inc., Defendant XSE Group, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 06/21/2013)   |
| 06/24/2013 | <u>289</u> | ANSWER to <u>233</u> Amended Complaint COUNTERCLAIM against Lexmark International, Inc. filed by Green Project, Inc.. (Foley, Michael) Modified to clarify docket text on 6/25/2013 (jlw). (Entered: 06/24/2013)  |
| 06/24/2013 | <u>290</u> | Corporate Disclosure Statement by Defendant Green Project, Inc.. (Foley, Michael) (Entered: 06/24/2013)   |
| 06/24/2013 | <u>291</u> | Corporate Disclosure Statement by Defendant Wal Group LLC. (Foley, Michael) (Entered: 06/24/2013)   |
| 06/24/2013 | <u>292</u> | MOTION to Sever <i>and Transfer</i> by Defendant Green Project, Inc.. (Attachments: # <u>1</u> Affidavit Declaration of Joseph Wu in Support of Green Project's Motion to Sever and Transfer, # <u>2</u> Text of Proposed Order Granting Green Project's Motion to Sever and Transfer) (Foley, Michael) (Entered: 06/24/2013)   |
| 06/24/2013 | <u>293</u> | Joint MOTION for Extension of Time New date requested 7/24/2013. <i>(to Respond to Complaint for Patent Infringement)</i> by Plaintiff Lexmark International, Inc., Defendant N & L Global Co.. (Attachments: # <u>1</u> Text of Proposed Order) (Loy, Steven) (Entered: 06/24/2013)  |
| 06/24/2013 | <u>294</u> | ANSWER to <u>233</u> Amended Complaint COUNTERCLAIM against Lexmark International, Inc. filed by Wal Group LLC. (Foley, Michael) Modified to clarify docket text on 6/25/2013 (jlw). (Entered: 06/24/2013)  |
| 06/24/2013 | <u>295</u> | ANSWER to <u>233</u> Amended Complaint filed by FBA Holding, Inc.. (Liles, James) Modified to clarify docket text on 6/25/2013 (jlw). (Entered: 06/24/2013)   |
| 06/25/2013 | <u>296</u> | STIPULATION ORDER FOR CONTEMPT granting <u>283</u> Joint Motion for Stipulation. Signed by Judge Michael R. Barrett on 6/25/13. (ba1) (Entered: 06/25/2013)   |



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| 06/25/2013 | <u>297</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE granting <u>284</u> Joint MOTION Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice filed by IJSS Inc. and Lexmark International, Inc.; IJSS Inc. terminated. Signed by Judge Michael R. Barrett on 6/25/13. (ba1) (Entered: 06/25/2013)   |
| 06/26/2013 | <u>298</u> | MOTION for Permanent Injunction , <i>Consent Judgment, and Dismissal with Prejudice</i> by Plaintiff Lexmark International, Inc.. Responses due by 7/22/2013 (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice) (Eidem Heinze, Audra) (Entered: 06/26/2013)   |
| 06/28/2013 | <u>299</u> | MOTION to Consolidate Cases <i>1:10-cv-564 and 1:13-cv-410</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 06/28/2013)  |
| 07/01/2013 | <u>300</u> | ORDER granting <u>293</u> Joint MOTION for Extension of Time New date requested 7/24/2013. <i>(to Respond to Complaint; Answer by N &amp; L Global Co. due 7/24/13. Signed by Judge Michael R. Barrett on 7/1/13. (ba1) (Entered: 07/01/2013)</i>  |
| 07/01/2013 | <u>301</u> | ORDER finding as moot <u>242</u> Motion to Strike ; granting <u>247</u> Motion to file Amended Complaint. Signed by Judge Michael R. Barrett on 7/1/13. (ba1) (Entered: 07/01/2013)  |
| 07/01/2013 | <u>302</u> | ORDER finding as moot <u>221</u> Motion for Extension of Time to File Response/Reply. Signed by Judge Michael R. Barrett on 7/1/13. (ba1) (Entered: 07/01/2013)  |
| 07/01/2013 | <u>303</u> | ORDER granting <u>288</u> Joint MOTION for Extension of Time to Respond to Complaint for Patent Infringement filed by Lexmark International, Inc.; XSE Group, Inc. answer due 8/23/2013. Signed by Judge Michael R. Barrett on 7/1/13. (ba1) (Entered: 07/01/2013)   |
| 07/01/2013 | <u>304</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE granting <u>298</u> MOTION for Permanent Injunction , <i>Consent Judgment, and Dismissal with Prejudice</i> filed by Lexmark International, Inc against Fuller International Corporation. Signed by Judge Michael R. Barrett on 7/1/13. (ba1) (Entered: 07/01/2013)  |
| 07/01/2013 | <u>305</u> | ORDER finding as moot and overruled re <u>204</u> Objection (non motion) filed by IJSS Inc. Signed by Judge Michael R. Barrett on 7/1/13. (ba1) (Entered: 07/01/2013)  |
| 07/03/2013 | <u>306</u> | Joint MOTION for Extension of Time New date requested 8/5/2013. <i>to Respond to First Amended Complaint</i> by Plaintiff Lexmark International, Inc., Defendant Onlinetechstores.com, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 07/03/2013)  |
| 07/03/2013 | <u>307</u> | Summons Issued as to ECOI US Supplies, Inc., Exprint International, Inc., Impression Products, Inc., MBC Trading, Inc., and Tech Optics, Inc.. (tt) . Modified on 7/3/2013 – PDF corrected and reattached. NEF Regenerated for viewing purposes (tt). (Entered: 07/03/2013)  |
| 07/08/2013 | <u>308</u> | RESPONSE in Opposition re <u>299</u> MOTION to Consolidate Cases <i>1:10-cv-564 and 1:13-cv-410</i> filed by Defendant Blue Trading LLC. (Gibson, Andre) (Entered: 07/08/2013)   |
| 07/08/2013 | <u>309</u> | RESPONSE in Opposition re <u>259</u> MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM MOTION to Dismiss for Lack of Jurisdiction MOTION to Change Venue filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Petition for a Writ of Certiorari, # <u>2</u> Exhibit B – Declaration of Audra C. Eidem Heinze, # <u>3</u> Exhibit C – Declaration of Leslie Raynor, # <u>4</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 07/08/2013) |
| 07/13/2013 | <u>310</u> | MOTION to Sever <i>and Transfer</i> by Defendant FBA Holding, Inc.. (Attachments: # <u>1</u> Exhibit 1, # <u>2</u> Exhibit 2, # <u>3</u> Exhibit 3, # <u>4</u> Exhibit 4, # <u>5</u> Exhibit 5, # <u>6</u> Exhibit 6, # <u>7</u> Exhibit 7, # <u>8</u> Exhibit 8) (Liles, James) (Entered: 07/13/2013)   |

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| 07/15/2013 | <u>311</u> | MOTION for Leave to Appear Pro Hac Vice of Thomas Tak-Wah Chan (Filing fee \$ 200, receipt number 0648-4180096) by Defendants Green Project, Inc., Wal Group LLC, Counter Claimants Green Project, Inc., Wal Group LLC. (Attachments: # <u>1</u> Exhibit 1 Certificate of Good Standing for Thomas Tak-Wah Chan, # <u>2</u> Text of Proposed Order Proposed Order Granting Motion for Admission Pro Hac Vice of Thomas Tak-Wah Chan) (Foley, Michael) (Entered: 07/15/2013)  |
| 07/15/2013 | <u>312</u> | MOTION for Leave to Appear Pro Hac Vice of Lena Nadine Bacani (Filing fee \$ 200, receipt number 0648-4180165) by Defendants Green Project, Inc., Wal Group LLC, Counter Claimants Green Project, Inc., Wal Group LLC. (Attachments: # <u>1</u> Exhibit 1 Certificate of Good Standing for Lena Nadine Bacani, # <u>2</u> Text of Proposed Order Proposed Order Granting Motion for Admission Pro Hac Vice of Lena Nadine Bacani) (Foley, Michael) (Entered: 07/15/2013)   |
| 07/16/2013 |            | Notice of Correction re: <u>312</u> MOTION for Leave to Appear Pro Hac Vice of Lena Nadine Bacani <u>311</u> MOTION for Leave to Appear Pro Hac Vice of Thomas Tak-Wah Chan. Counsel was directed to file the appropriate Certificate of Good Standing. (jlw) (Entered: 07/16/2013)  |
| 07/17/2013 | <u>313</u> | Unopposed MOTION for Extension of Time to File Response/Reply as to <u>309</u> Response in Opposition to Motion, New date requested 8/5/2013. by Defendant Blue Trading LLC. (Attachments: # <u>1</u> Text of Proposed Order) (Gibson, Andre) (Entered: 07/17/2013)  |
| 07/17/2013 | <u>314</u> | Joint MOTION for Extension of Time to File Answer re <u>233</u> Amended Complaint,,,,,, New date requested 8/23/2013. by Plaintiff Lexmark International, Inc., Defendant N &L Global Co.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 07/17/2013)  |
| 07/17/2013 | <u>315</u> | SUMMONS Returned Executed as to Defendant MBC Trading, Inc.. MBC Trading, Inc. served on 7/9/2013, answer due 7/30/2013. (Eidem Heinze, Audra) (Entered: 07/17/2013)   |
| 07/17/2013 | <u>316</u> | SUMMONS Returned Executed as to Defendant Impression Products, Inc.. Impression Products, Inc. served on 7/10/2013, answer due 7/31/2013. (Eidem Heinze, Audra) (Entered: 07/17/2013)  |
| 07/17/2013 | <u>317</u> | ORDER granting <u>306</u> Joint MOTION for Extension of Time to Respond to First Amended Complaint filed against Onlinetechstores.com, Inc. by Lexmark International, Inc.; Onlinetechstores.com, Inc. answer due 8/5/2013. Signed by Judge Michael R. Barrett on 7/17/13. (ba1) (Entered: 07/17/2013)   |
| 07/18/2013 | <u>318</u> | Reply re <u>289</u> Answer to Amended Complaint, Counterclaim of <i>Green Project, Inc.</i> by Plaintiff Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 07/18/2013)  |
| 07/18/2013 | <u>319</u> | Reply re <u>294</u> Answer to Amended Complaint, Counterclaim of <i>Wal Group LLC</i> by Plaintiff Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 07/18/2013)  |
| 07/18/2013 | <u>320</u> | RESPONSE in Opposition re <u>292</u> MOTION to Sever and Transfer by <i>Green Project, Inc.</i> filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Declaration of Brent Lambert, # <u>2</u> Declaration of Audra C. Eidem Heinze, # <u>3</u> Ex A – Excerpts from Deposition of Stephen Sherman, # <u>4</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 07/18/2013)  |
| 07/19/2013 | <u>321</u> | MOTION for Order to <i>Authorize Alternative Service of Foriegn Defendants</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 07/19/2013)  |
| 07/19/2013 | <u>322</u> | BRIEF re <u>321</u> MOTION for Order to <i>Authorize Alternative Service of Foriegn Defendants</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1, # <u>2</u> Exhibit 2, # <u>3</u> Exhibit 3, # <u>4</u> Exhibit 4, # <u>5</u> Exhibit 5, # <u>6</u> Exhibit 6, # <u>7</u> Exhibit 7, # <u>8</u> Exhibit 8, # <u>9</u> Exhibit 9, # <u>10</u> Exhibit 10, # <u>11</u> Exhibit 11, # <u>12</u> Exhibit 12, # <u>13</u> Exhibit 13, # <u>14</u> Exhibit 14) (Eidem Heinze, Audra) (Entered: 07/19/2013) |
| 07/22/2013 | <u>323</u> | NOTICE of Appearance by Crystal L Maluchnik for Defendant Impression Products, Inc. (Maluchnik, Crystal) (Entered: 07/22/2013)   |

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| 07/22/2013 | <u>324</u> | MOTION for Leave to Appear Pro Hac Vice of Edward F. O'Connor (Filing fee \$ 200, receipt number 0648-4190123) by Defendant Impression Products, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Maluchnik, Crystal) (Entered: 07/22/2013)   |
| 07/22/2013 | <u>325</u> | SUMMONS Returned Executed as to Defendant ECOI US Supplies, Inc.. ECOI US Supplies, Inc. served on 7/9/2013, answer due 7/30/2013. (Eidem Heinze, Audra) (Entered: 07/22/2013)   |
| 07/23/2013 | <u>326</u> | <p>Transcript of Proceedings (Hearing on Motion for Contempt) held on 6/17/13, before Judge Michael R. Barrett. Court Reporter/Transcriber Maryann Maffia (Official), Telephone number 513-564-7500. Transcript may be viewed at the court public terminal or purchased through the Court Reporter/Transcriber before the deadline for Release of Transcript Restriction. After that date it may be obtained through PACER.</p> <p>NOTICE RE: REDACTION OF TRANSCRIPTS: Within 5 business days of this filing, each party shall inform the Court, by filing a Notice of Redaction, of the party's intent to redact personal data identifiers from the electronic transcript of the court proceeding. The policy is located on our website at www.ohsd.uscourts.gov (Forms – Electronic Availability of Transcripts). Please read this policy carefully.</p> <p>For a complete copy of a transcript, please contact the Court Reporter or the Clerk's Office. Redaction Request due 8/13/2013. Redacted Transcript Deadline set for 8/23/2013. Release of Transcript Restriction set for 10/21/2013. (lk) (Entered: 07/23/2013)</p> |
| 07/24/2013 | <u>327</u> | ORDER granting <u>314</u> Motion for Extension of Time to Answer re <u>314</u> Joint MOTION for Extension of Time to File Answer re <u>233</u> Amended Complaint; N & L Global Co. answer due 8/23/2013. Signed by Judge Michael R. Barrett on 7/24/13. (ba1) (Entered: 07/24/2013)  |
| 07/24/2013 | <u>328</u> | ORDER granting <u>313</u> Motion for Extension of Time to File Response/Reply re <u>259</u> MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM MOTION to Dismiss for Lack of Jurisdiction MOTION to Change Venue ; Replies due by 8/5/2013. Signed by Judge Michael R. Barrett on 7/24/13. (ba1) (Entered: 07/24/2013)   |
| 07/24/2013 | <u>329</u> | MOTION for Entry of Clerk's Default of Prinko Imaging Co. (USA), Inc. by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Proposed Entry of Default) (Eidem Heinze, Audra) (Entered: 07/24/2013)  |
| 07/25/2013 | <u>330</u> | Clerk's ENTRY OF DEFAULT as to Defendant Prinko Image Co. (USA) (ba1) (Entered: 07/25/2013)  |
| 07/25/2013 | <u>331</u> | REPLY to Response to Motion re <u>299</u> MOTION to Consolidate Cases <i>1:10-cv-564 and 1:13-cv-410</i> filed by Plaintiff Lexmark International, Inc.. (Loy, Steven) (Entered: 07/25/2013)   |
| 07/26/2013 | <u>332</u> | MOTION for Extension of Time New date requested 8/15/2013. <i>for Defendant, MBC Trading, Inc. to Respond to the First Amended Complaint</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 07/26/2013)  |
| 07/26/2013 | <u>333</u> | MOTION <i>for Entry of Clerk's Default of Direct Billing International Incorporated</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Proposed Entry of Default) (Eidem Heinze, Audra) (Entered: 07/26/2013)  |
| 07/29/2013 | <u>334</u> | SUMMONS Returned Executed as to Defendant Tech Optics, Inc.. Tech Optics, Inc. served on 7/12/2013, answer due 8/2/2013. (Eidem Heinze, Audra) (Entered: 07/29/2013)   |
| 07/30/2013 | <u>335</u> | MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM by Defendant Impression Products, Inc.. (Carr, George) (Entered: 07/30/2013)  |

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| 07/30/2013 | <u>336</u> | NOTICE by Defendant Wal Group LLC, Counter Claimant Wal Group LLC re <u>311</u> MOTION for Leave to Appear Pro Hac Vice of Thomas Tak-Wah Chan (Filing fee \$ 200, receipt number 0648-4180096) (Attachments: # <u>1</u> Exhibit Certificate of Good Standing from the Supreme Court of California) (Foley, Michael) (Entered: 07/30/2013)  |
| 07/30/2013 | <u>337</u> | NOTICE by Defendant Green Project, Inc., Counter Claimant Green Project, Inc. re <u>311</u> MOTION for Leave to Appear Pro Hac Vice of Thomas Tak-Wah Chan (Filing fee \$ 200, receipt number 0648-4180096) (Attachments: # <u>1</u> Exhibit Certificate of Good Standing from the Supreme Court of California) (Foley, Michael) (Entered: 07/30/2013)  |
| 07/30/2013 | <u>338</u> | NOTICE by Defendant Wal Group LLC, Counter Claimant Wal Group LLC re <u>312</u> MOTION for Leave to Appear Pro Hac Vice of Lena Nadine Bacani (Filing fee \$ 200, receipt number 0648-4180165) (Attachments: # <u>1</u> Exhibit Certificate of Good Standing from the Supreme Court of California) (Foley, Michael) (Entered: 07/30/2013)   |
| 07/30/2013 | <u>339</u> | NOTICE by Defendant Green Project, Inc., Counter Claimant Green Project, Inc. re <u>312</u> MOTION for Leave to Appear Pro Hac Vice of Lena Nadine Bacani (Filing fee \$ 200, receipt number 0648-4180165) (Attachments: # <u>1</u> Exhibit Certificate of Good Standing from the Supreme Court of California) (Foley, Michael) (Entered: 07/30/2013)   |
| 07/31/2013 | <u>340</u> | Joint MOTION for Extension of Time to File Answer re <u>233</u> Amended Complaint,,,,,, New date requested 9/5/2013. <i>for Onlinetechstores.com, Inc. d/b/a Supplierswholesalers.com to Answer</i> by Plaintiff Lexmark International, Inc., Defendant Onlinetechstores.com, Inc. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) Modified to include defendant as filer on 8/1/2013 (eh1). (Entered: 07/31/2013) |
| 07/31/2013 | <u>341</u> | Joint MOTION for Extension of Time to File Answer re <u>233</u> Amended Complaint,,,,,, New date requested 9/16/2013. <i>For Tech Optics, Inc. to Respond</i> by Plaintiff Lexmark International, Inc., Defendant Tech Optics, Inc. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) Modified to include defendant as filer on 8/1/2013 (eh1). (Entered: 07/31/2013)  |
| 07/31/2013 | <u>342</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice between Lexmark and Optimus) (Shull, Jason) (Entered: 07/31/2013)  |
| 07/31/2013 | <u>343</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice between Lexmark and Printronic, # <u>2</u> Exhibit 2 – Final Judgment and Dismissal) (Shull, Jason) (Entered: 07/31/2013)  |
| 08/01/2013 | <u>344</u> | REPLY to Response to Motion re <u>292</u> MOTION to Sever <i>and Transfer</i> filed by Defendant Green Project, Inc., Counter Claimant Green Project, Inc.. (Attachments: # <u>1</u> Exhibit Norman IP v Lexmakr) (Foley, Michael) (Entered: 08/01/2013)  |
| 08/01/2013 | <u>345</u> | ORDER granting <u>324</u> Motion for Leave to Appear Pro Hac Vice of Edward F. O'Connor for Defendant Impression Products, Inc.. Signed by Judge Michael R. Barrett on 8/1/13. (ba1) (Entered: 08/01/2013)  |
| 08/01/2013 | <u>346</u> | ORDER granting <u>311</u> Motion for Leave to Appear Pro Hac Vice of Thomas Tak-Wah Chan for Defendants. Signed by Judge Michael R. Barrett on 8/1/13. (ba1) (Entered: 08/01/2013)  |
| 08/01/2013 | <u>347</u> | ORDER granting <u>312</u> Motion for Leave to Appear Pro Hac Vice of Lena Nadine Bacani for Defendants Wal Group, LLC and Green Project, Inc.. Signed by Judge Michael R. Barrett on 8/1/13. (ba1) (Entered: 08/01/2013)  |
| 08/02/2013 | <u>348</u> | ORDER granting <u>340</u> Motion for Extension of Time to Answer re <u>233</u> Amended Complaint; Onlinetechstores.com, Inc. answer due 9/5/2013. Signed by Judge   |



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|            |            | Michael R. Barrett on 8/2/13. (ba1) (Entered: 08/02/2013)   |
| 08/02/2013 | <u>349</u> | ORDER granting <u>341</u> Motion for Extension of Time to Answer re <u>233</u> Amended Complaint; Tech Optics, Inc. answer due 9/16/2013. Signed by Judge Michael R. Barrett on 8/2/13. (ba1) (Entered: 08/02/2013)   |
| 08/02/2013 | <u>350</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE granting <u>342</u> MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice filed by Lexmark International, Inc and Optimus Graphics Corporation. Signed by Judge Michael R. Barrett on 8/2/13. (ba1) (Entered: 08/02/2013)   |
| 08/02/2013 | <u>351</u> | STIPULATED PERMANENT INJUNCTION as to Printronic Corporation. Signed by Judge Michael R. Barrett on 8/2/13. (ba1) (Entered: 08/02/2013)   |
| 08/02/2013 | <u>352</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE as to Printronic Corporation. Signed by Judge Michael R. Barrett on 8/2/13. (ba1) (Entered: 08/02/2013)   |
| 08/05/2013 | <u>353</u> | MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction – ECOI US Supplies, # <u>2</u> Exhibit 2 – Final Judgment and Dismissal – ECOI US Supplies) (Shull, Jason) (Entered: 08/05/2013)   |
| 08/05/2013 | <u>354</u> | REPLY to Response to Motion re <u>259</u> MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM MOTION to Dismiss for Lack of Jurisdiction MOTION to Change Venue filed by Defendant Blue Trading LLC. (Attachments: # <u>1</u> Exhibit 1 – Respondent ITC Brief – Ninestar v. ITC, # <u>2</u> Exhibit 2 – Second Declaration of Alfredo Alvarado, # <u>3</u> Exhibit 3 – Declaration of Steven Tirrell) (Gibson, Andre) (Entered: 08/05/2013)                                   |
| 08/06/2013 | <u>355</u> | ORDER granting <u>332</u> MOTION for Extension of Time for Defendant MBC Trading, Inc. to Respond to <u>233</u> First Amended Complaint filed by Lexmark International, Inc.; MBC Trading, Inc. answer due 8/15/2013. Signed by Judge Michael R. Barrett on 8/6/13. (ba1) (Entered: 08/06/2013)   |
| 08/06/2013 | <u>356</u> | MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction – XSE Group, # <u>2</u> Exhibit 2 – Final Judgment – XSE Group) (Shull, Jason) (Entered: 08/06/2013)   |
| 08/07/2013 | <u>357</u> | RESPONSE in Opposition re <u>310</u> MOTION to Sever <i>and Transfer</i> by <i>FBA Holding, Inc.</i> filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Declaration of Audra Eidem Heinze, # <u>2</u> Exhibit B – Declaration of Timothy Meece, # <u>3</u> Exhibit C – Declaration of Tony Diab, # <u>4</u> Exhibit D – Excerpt from Gardner Transcript, # <u>5</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 08/07/2013) |
| 08/13/2013 | <u>358</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE OF ECOI re <u>353</u> MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal. Signed by Judge Michael R. Barrett on 8/10/13. (ba1) (Entered: 08/13/2013)   |
| 08/13/2013 | <u>359</u> | STIPULATED PERMANENT INJUNCTION RE <u>353</u> MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal permanent junction. Signed by Judge Michael R. Barrett on 8/10/13. (ba1) (Entered: 08/13/2013)  |
| 08/15/2013 | <u>360</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE re <u>356</u> MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal filed by Lexmark International, Inc. XSE Group, Inc. terminated. Signed by Judge Michael R. Barrett on 8/10/13. (ba1) (Entered: 08/15/2013)   |
| 08/15/2013 | <u>361</u> | STIPULATED PERMANENT INJUNCTION re <u>356</u> MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 8/10/13. (ba1) (Entered: 08/15/2013)   |

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| 08/19/2013 | <u>362</u> | Joint MOTION for Extension of Time to File Answer re <u>233</u> Amended Complaint,,,,,, New date requested 9/20/2013. <i>For LD Products, Inc. to Respond</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 08/19/2013)  |
| 08/21/2013 | <u>363</u> | ORDER granting in part and denying in part <u>321</u> Motion for Order to Serve Foreign Defendants. Signed by Judge Michael R. Barrett on 8/20/13. (ba1) (Entered: 08/21/2013)  |
| 08/22/2013 | <u>364</u> | NOTICE of Appearance by David Graham Kern for Defendant N &L Global Co. (Kern, David) (Entered: 08/22/2013)   |
| 08/22/2013 | <u>365</u> | Corporate Disclosure Statement by Defendant N &L Global Co.. (Kern, David) (Entered: 08/22/2013)  |
| 08/22/2013 | <u>366</u> | ANSWER to <u>233</u> Amended Complaint,,,,,, , COUNTERCLAIM against Lexmark International, Inc. filed by N &L Global Co.. (Kern, David) (Entered: 08/22/2013)   |
| 08/22/2013 | <u>367</u> | RESPONSE to Motion re <u>335</u> MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Supplemental Brief for Petitioners) (Eidem Heinze, Audra) (Entered: 08/22/2013)  |
| 08/23/2013 | <u>368</u> | REPLY to Response to Motion re <u>335</u> MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM filed by Defendant Impression Products, Inc.. (O'Connor, Edward) (Entered: 08/23/2013)   |
| 08/26/2013 | <u>369</u> | ORDER granting <u>362</u> Joint MOTION for Extension of Time to File for LD Products to Answer re <u>233</u> Amended Complaint filed by Lexmark International, Inc; LD Products, Inc. answer due 9/20/2013. Signed by Judge Michael R. Barrett on 8/23/13. (ba1) (Entered: 08/26/2013)  |
| 08/26/2013 | <u>370</u> | REPLY to Response to Motion re <u>310</u> MOTION to Sever <i>and Transfer</i> filed by Defendant FBA Holding, Inc.. (Attachments: # <u>1</u> Exhibit A) (Liles, James) (Entered: 08/26/2013)  |
| 08/26/2013 | <u>371</u> | Summons Issued as to Core Servicios Informaticos S.I., Recyca BVBA. (lk) (Entered: 08/26/2013)  |
| 08/27/2013 | <u>372</u> | Supplemental Memorandum Supporting re <u>310</u> MOTION to Sever <i>and Transfer</i> filed by Defendant FBA Holding, Inc.. (Attachments: # <u>1</u> Supplement with Previous Reference Exhibit) (Liles, James) (Entered: 08/27/2013)  |
| 08/28/2013 | <u>373</u> | Summons Issued as to Green Cartridge Company, NGS S.A., Refiltoner. (eh1) (Entered: 08/28/2013)   |
| 08/28/2013 | <u>374</u> | Clerk's CERTIFICATE of Mailing re <u>233</u> AMENDED COMPLAINT (First) and <u>373</u> Summons Issued. (eh1) (Entered: 08/28/2013)   |
| 08/28/2013 | <u>375</u> | Clerk's ENTRY OF DEFAULT as to Direct Billing International Incorporated d/b/a Office Supply Outfitters. (ba1) (Entered: 08/28/2013)  |
| 08/30/2013 | <u>376</u> | MOTION for Extension of Time New date requested 12/2/2013. <i>of the Deadline to Serve Foreign Defendants</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 08/30/2013)  |
| 08/30/2013 | <u>377</u> | MOTION for Order to <i>Authorize Alternative Service of Foriegn Defendants (Renewed)</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A– Wahlstrom Declaration, # <u>2</u> Exhibit B– Hanson Declaration, # <u>3</u> Exhibit C– Franz Declaration, # <u>4</u> Exhibit D– DBReport, # <u>5</u> Exhibit E– California SOS records, # <u>6</u> Exhibit F– Richeng website capture, # <u>7</u> Exhibit G– China 2008 Hague Responses, # <u>8</u> Exhibit H– ITC Order, # <u>9</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 08/30/2013) |
| 09/03/2013 | <u>378</u> | MOTION for Leave to File <i>Sur–Reply to Motion to Dismiss of Defendant Impression Products, Inc.</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Proposed Sur–Reply) (Eidem Heinze, Audra) (Entered: 09/03/2013)  |

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| 09/03/2013 | <u>379</u> | RESPONSE in Opposition re <u>378</u> MOTION for Leave to File <i>Sur-Reply to Motion to Dismiss of Defendant Impression Products, Inc.</i> filed by Defendant Impression Products, Inc.. (O'Connor, Edward) (Entered: 09/03/2013)   |
| 09/04/2013 | <u>380</u> | Clerk's AMENDED CERTIFICATE of Mailing (FedEx) re <u>233</u> AMENDED COMPLAINT (First) and <u>373</u> Summons Issued. (eh1) (Entered: 09/04/2013)   |
| 09/04/2013 | <u>381</u> | MOTION for Entry of Stipulated Preliminary Injunction executed by Defendant NLGlobal Co. by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Preliminary Injunction) (Eidem Heinze, Audra) (Entered: 09/04/2013)  |
| 09/05/2013 | <u>382</u> | MOTION for Leave to Appear Pro Hac Vice of Sang N. Dang (Filing fee \$ 200) by Defendant N &L Global Co.. (Attachments: # <u>1</u> Exhibit Certificate of Good Standing) (Kern, David) (Entered: 09/05/2013)  |
| 09/05/2013 | <u>383</u> | NOTICE of Appearance by David Graham Kern for Defendant Onlinetechstores.com, Inc. (Kern, David) (Entered: 09/05/2013)  |
| 09/05/2013 | <u>384</u> | Corporate Disclosure Statement by Defendant Onlinetechstores.com, Inc.. (Kern, David) (Entered: 09/05/2013)   |
| 09/05/2013 | <u>385</u> | ANSWER to <u>233</u> Amended Complaint,,,,,, , COUNTERCLAIM against Lexmark International, Inc. filed by Onlinetechstores.com, Inc.. (Kern, David) (Entered: 09/05/2013)  |
| 09/05/2013 | <u>386</u> | MOTION for Leave to Appear Pro Hac Vice of Sang N. Dang, Andrew B. Chen, Saeid Mirsafian (Filing fee \$ 600) by Defendant Onlinetechstores.com, Inc.. (Attachments: # <u>1</u> Exhibit Dang Certificate of Good Standing, # <u>2</u> Exhibit Chen Certificate of Good Standing, # <u>3</u> Exhibit Mirsafian Certificate of Good Standing) (Kern, David) (Additional attachment(s) added on 9/5/2013: # <u>4</u> Filing Fee Receipt) (eh1). (Entered: 09/05/2013) |
| 09/05/2013 |            | Filing fee: \$ 600.00, receipt number 100CIN019818 re <u>386</u> MOTION for Leave to Appear Pro Hac Vice of Sang N. Dang, Andrew B. Chen, Saeid Mirsafian. (eh1) (Entered: 09/05/2013)  |
| 09/05/2013 | <u>387</u> | STIPLUATED PRELIMINARY INJUCTION (NLGlobal Co. d/b/a NLGlobal Corporation) signed by Judge Michael R. Barrett on 9/5/13. (eh) (Entered: 09/05/2013)   |
| 09/05/2013 |            | Notice of Correction re: <u>387</u> Stipulated Preliminary Injunction; NLGlobal have entered into a stipulated preliminary injunction and are therefore not terminated. (ba1) (Entered: 10/01/2013)   |
| 09/06/2013 |            | Notice of Correction re: <u>383</u> Notice of Appearance This document was filed without a certificate of service. Counsel was notified to file one under Notice other and link it back to document <u>383</u> . (jlw) (Entered: 09/06/2013)  |
| 09/11/2013 | <u>388</u> | NOTICE by Defendant Onlinetechstores.com, Inc. re <u>383</u> Notice of Appearance <i>Certificate of Service to Notice of Appearance</i> (Kern, David) (Entered: 09/11/2013)   |
| 09/11/2013 | <u>389</u> | ORDER granting <u>377</u> Plaintiff Lexmark International, Inc.'s Renewed Motion and Memorandum in Support for Permission to Serve the Foreign Defendants Through Alternative Means Pursuant to Fed. R. Civ. P. 4(f)(3). Signed by Judge Michael R. Barrett on 9/11/13. (lk) (Entered: 09/11/2013)  |
| 09/11/2013 | <u>390</u> | ORDER granting <u>376</u> Motion for Extension of Time. Plaintiff shall have up to and including December 2, 2013 to serve the First Amended Complaint. Signed by Judge Michael R. Barrett on 9/11/13. (lk) (Entered: 09/11/2013)   |
| 09/13/2013 | <u>391</u> | Reply re <u>366</u> Answer to Amended Complaint, Counterclaim <i>of Defendant N &amp;L Global Co.</i> by Plaintiff Lexmark International, Inc.. (Shull, Jason) (Entered: 09/13/2013)  |
| 09/13/2013 | <u>392</u> | SUMMONS Returned Executed as to Defendants Green Cartridge Company served on 9/9/2013, answer due 9/30/2013; NGS S.A. served on 9/9/2013, answer due 9/30/2013; Refilterner served on 9/11/2013, answer due 10/2/2013. (eh1) (Entered: 09/13/2013)  |

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| 09/13/2013 | <u>393</u> | Joint MOTION for Extension of Time New date requested 10/18/2013. <i>for Defendant LD Products to Respond to First Amended Complaint</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 09/13/2013)  |
| 09/16/2013 | <u>394</u> | Summons Issued as to Eco Service China Ltd., Interseroh Product Cycle GmbH, Shanghai Orink Infotech International Co., Ltd., and Zhuhai Richeng Development Co., Ltd.. (tt) (Entered: 09/16/2013)  |
| 09/16/2013 | <u>395</u> | Second MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM by Defendant Impression Products, Inc.. (O'Connor, Edward) (Entered: 09/16/2013)   |
| 09/16/2013 | <u>396</u> | MOTION for Entry of Order of Contempt, Stipulated Permanent Injunction, Final Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Stipulated Order of Contempt between Lexmark and Wal Group, LLC, # <u>2</u> Stipulated Permanent Injunction between Lexmark and Wal Group, LLC, # <u>3</u> Final Judgment and Dismissal with Prejudice) (Shull, Jason) (Entered: 09/16/2013)  |
| 09/16/2013 | <u>397</u> | MOTION for Entry of Stipulated Permanent Injunction and Final Judgment and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Stipulated Permanent Injunction between Lexmark and Standard Image USA, Inc. d/b/a Imaging Standard, Inc., # <u>2</u> Final Judgment and Dismissal with Prejudice) (Shull, Jason) (Entered: 09/16/2013)   |
| 09/16/2013 | <u>398</u> | MOTION for Extension of Time to File Answer re <u>233</u> Amended Complaint,,,,,, New date requested 11/15/2013. by Defendant Tech Optics, Inc.. (Kern, David) (Entered: 09/16/2013)   |
| 09/17/2013 | <u>399</u> | NOTICE by Defendant Onlinetechstores.com, Inc. re <u>386</u> MOTION for Leave to Appear Pro Hac Vice of Sang N. Dang, Andrew B. Chen, Saeid Mirsafian (Filing fee \$ 600), <u>382</u> MOTION for Leave to Appear Pro Hac Vice of Sang N. Dang (Filing fee \$ 200) (Attachments: # <u>1</u> Exhibit Dang Certificate of Good Standing, # <u>2</u> Exhibit Mirsafian Certificate of Good Standing, # <u>3</u> Exhibit Chen Certificate of Good Standing) (Kern, David) (Entered: 09/17/2013) |
| 09/17/2013 | <u>400</u> | SUMMONS Returned Executed as to Defendant Core Servicios Informaticos S.I.. Core Servicios Informaticos S.I. served on 8/30/2013, answer due 9/20/2013. (Loy, Steven) (Entered: 09/17/2013)  |
| 09/17/2013 | <u>401</u> | SUMMONS Returned Executed as to Defendant Recyca BVBA. Recyca BVBA served on 8/30/2013, answer due 9/20/2013. (Loy, Steven) (Entered: 09/17/2013)  |
| 09/17/2013 | <u>402</u> | Joint MOTION for Extension of Time to File Response/Reply New date requested 10/15/2013. <i>to Onlinetechstores Counterclaims</i> by Plaintiff Lexmark International, Inc., Counter Claimant Onlinetechstores.com, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Shull, Jason) (Entered: 09/17/2013)   |
| 09/19/2013 | <u>403</u> | STIPULATION OF EXTENSION OF TIME TO MOVE OR PLEAD IN RESPONSE TO AMENDED COMPLAINT (233) by Defendant Core Servicios Informaticos S.I.. (Schuler, Robert) (Entered: 09/19/2013)  |
| 09/23/2013 | <u>404</u> | STIPULATION – <i>Amended Stipulation of Extension of Time for Defendant Core Servicios to Move or Plead to the Amended Complaint</i> by Defendant Core Servicios Informaticos S.I., Plaintiff Lexmark International, Inc. (Schuler, Robert) Modified to include plaintiff as filer on 9/24/2013 (eh1). (Entered: 09/23/2013)   |
| 09/26/2013 | <u>405</u> | MOTION to Refer the Action to Mediation by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A, # <u>2</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 09/26/2013)   |
| 09/27/2013 | <u>406</u> | ORDER granting <u>402</u> Motion for Extension of Time to File Response/Reply to Counterclaims; Responses due by 10/15/2013. Signed by Judge Michael R. Barrett on 9/26/13. (ba1) (Entered: 09/27/2013)  |
| 09/27/2013 | <u>407</u> | ORDER granting <u>393</u> Motion for Extension of Time for LP Products to response to the <u>233</u> First Amended Complaint until 10/18/13. Signed by Judge Michael R. Barrett on 9/26/13. (ba1) (Entered: 09/27/2013)  |



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| 09/27/2013 | <u>408</u> | ORDER granting <u>224</u> Joint Motion for Entry of Stipulated Entry Granting Motion to Contempt. Signed by Judge Michael R. Barrett on 9/26/13. (ba1) (Entered: 09/27/2013)   |
| 09/27/2013 | <u>409</u> | ORDER granting <u>382</u> Motion for Leave to Appear Pro Hac Vice of Sang D. Dang; granting <u>386</u> Motion for Leave to Appear Pro Hac Vice of Sang D. Dang, Andrew B. Chen and Saeid Mirsafian. Signed by Judge Michael R. Barrett on 9/26/13. (ba1) (Entered: 09/27/2013)   |
| 09/27/2013 | <u>410</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE as to Wal Group LLC and Wal Group LLC. Signed by Judge Michael R. Barrett on 9/20/13. (ba1) (Entered: 09/27/2013)  |
| 09/27/2013 | <u>411</u> | STIPULATED PERMANENT INJUNCTION. Signed by Judge Michael R. Barrett on 9/20/13. (ba1) (Entered: 09/27/2013)  |
| 09/27/2013 | <u>412</u> | STIPULATED ORDER OF CONTEMPT. Signed by Judge Michael R. Barrett on 9/27/13. (ba1) (Entered: 09/27/2013)   |
| 09/27/2013 | <u>413</u> | ORDER granting <u>396</u> MOTION for Entry of Order of Contempt, Stipulated Permanent Injunction, Final Judgment and Dismissal with Prejudice filed by Lexmark International, Inc.. Signed by Judge Michael R. Barrett on 9/27/13. (ba1) (Entered: 09/27/2013)   |
| 09/27/2013 | <u>414</u> | ORDER granting <u>397</u> Motion for Entry of Stipulated Permanent Injunction and Final Judgment and Dismissal with Prejudice against Standard Image USA, Inc.. Signed by Judge Michael R. Barrett on 9/27/13. (ba1) (Entered: 09/27/2013)   |
| 09/27/2013 | <u>415</u> | ORDER granting <u>398</u> Motion for Extension of Time to Answer re <u>233</u> Amended Complaint; Tech Optics, Inc. answer due 11/15/2013. Signed by Judge Michael R. Barrett on 9/27/13. (ba1) (Entered: 09/27/2013)  |
| 09/27/2013 | <u>416</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE as to Standard Image USA, Inc.. Signed by Judge Michael R. Barrett on 9/27/13. (ba1) (Entered: 09/27/2013)   |
| 09/27/2013 | <u>417</u> | STIPULATED PERMANENT INJUNCTION. Signed by Judge Michael R. Barrett on 9/27/13. (ba1) (Entered: 09/27/2013)  |
| 09/27/2013 | <u>418</u> | RESPONSE in Opposition re <u>405</u> MOTION to Refer the Action to Mediation filed by Defendant Impression Products, Inc.. (O'Connor, Edward) (Entered: 09/27/2013)  |
| 09/30/2013 | <u>419</u> | MOTION for Default Judgment against Prinko Image Co. (USA), Inc. by Plaintiff Lexmark International, Inc.. Responses due by 10/24/2013 (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – Email from Prinko, # <u>3</u> Exhibit B – Declaration of Andrew Gardner, # <u>4</u> Exhibit C – Declaration of Breseman (filed under seal), # <u>5</u> Exhibit D – Declaration of Shull, # <u>6</u> Exhibit E – Order Granting Lexmark's Motion for Judgment by Default) (Loy, Steven) (Entered: 09/30/2013) |
| 09/30/2013 | <u>420</u> | SUMMONS Returned Executed as to Defendant Eco Service China Ltd.. Eco Service China Ltd. served on 9/18/2013, answer due 10/9/2013. (Loy, Steven) (Entered: 09/30/2013)  |
| 09/30/2013 | <u>421</u> | SUMMONS Returned Executed as to Defendant Interseroh Product Cycle GmbH. Interseroh Product Cycle GmbH served on 9/18/2013, answer due 10/9/2013. (Loy, Steven) (Entered: 09/30/2013)  |
| 09/30/2013 | <u>422</u> | SUMMONS Returned Executed as to Defendant Shanghai Orink Infotech International Co., Ltd.. Shanghai Orink Infotech International Co., Ltd. served on 9/18/2013, answer due 10/9/2013. (Loy, Steven) (Entered: 09/30/2013)  |
| 09/30/2013 | <u>423</u> | SUMMONS Returned Executed as to Defendant Zhuhai Richeng Development Co., Ltd.. Zhuhai Richeng Development Co., Ltd. served on 9/18/2013, answer due 10/9/2013. (Loy, Steven) (Entered: 09/30/2013)  |
| 10/02/2013 | <u>425</u> | Motion for Contempt <i>against Direct Billing for Violation of This Court's Permanent Injunction Order</i> , MOTION for Default Judgment against Direct Billing ( Responses due by 10/28/2013) by Plaintiff Lexmark International, Inc..   |

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|            |            | (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – Declaration of Gardner, # <u>3</u> Exhibit B – Declaration of Reinholtz, Part 1, # <u>4</u> Exhibit B – Declaration of Reinholtz, Part 2, # <u>5</u> Exhibit B – Declaration of Reinholtz, Part 3, # <u>6</u> Exhibit B – Declaration of Reinholtz, Part 4, # <u>7</u> Exhibit B – Declaration of Reinholtz, Part 5, # <u>8</u> Exhibit B – Declaration of Reinholtz, Part 6, # <u>9</u> Exhibit B – Declaration of Reinholtz, Part 7, # <u>10</u> Exhibit C – Declaration of Breseman (filed under seal), # <u>11</u> Exhibit D – Declaration of Shull, # <u>12</u> Exhibit E – Order Granting Lexmark's Motions) (Loy, Steven) Modified on 7/23/2014 (ba1) to terminate motion per <u>674</u> Order granting the withdrawal. (Entered: 10/02/2013) |
| 10/03/2013 |            | Notice of Correction re: Due to filing error and at the request of counsel, Ex. B to Doc. <u>419</u> and Ex. A to Doc. <u>425</u> sealed by clerk. These two documents are subject to <u>117</u> PROTECTIVE ORDER. (eh1) (Entered: 10/03/2013)  |
| 10/09/2013 | <u>427</u> | NOTICE of Appearance by David Graham Kern for Defendant Interseroh Product Cycle GmbH (Kern, David) (Entered: 10/09/2013)   |
| 10/09/2013 | <u>428</u> | MOTION for Extension of Time to File Answer New date requested 12/9/2013. by Defendant Interseroh Product Cycle GmbH. (Kern, David) (Entered: 10/09/2013)   |
| 10/09/2013 | <u>429</u> | MOTION for Leave to File <i>Second Amended Complaint to Add Defendants</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – Proposed Second Amended Complaint, # <u>3</u> Exhibit B – Webpages on Eco Services, # <u>4</u> Text of Proposed Order) (Shull, Jason) (Entered: 10/09/2013)   |
| 10/10/2013 | <u>430</u> | MOTION to Withdraw as Attorney by Defendant Core Servicios Informaticos S.I.. (Attachments: # <u>1</u> Affidavit of Counsel Robert G. Schuler) (Schuler, Robert) (Entered: 10/10/2013)  |
| 10/10/2013 | <u>431</u> | RESPONSE in Opposition re <u>395</u> Second MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM filed by Plaintiff Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 10/10/2013)  |
| 10/11/2013 | <u>432</u> | RESPONSE in Opposition re <u>430</u> MOTION to Withdraw as Attorney by Defendant Core Servicios Informaticos S.I. filed by Plaintiff Lexmark International, Inc.. (Shull, Jason) (Entered: 10/11/2013)  |
| 10/11/2013 | <u>433</u> | Application to Clerk for entry of default against MBC Trading . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Default) (Shull, Jason) (Entered: 10/11/2013)   |
| 10/11/2013 | <u>434</u> | REPLY to Response to Motion re <u>395</u> Second MOTION TO DISMISS FOR FAILURE TO STATE A CLAIM filed by Defendant Impression Products, Inc.. (O'Connor, Edward) (Entered: 10/11/2013)  |
| 10/14/2013 | <u>435</u> | [FORMER DOC. 435 – PLEASE DISREGARD. FILED IN ERROR] Reply re <u>385</u> Answer to Amended Complaint, Counterclaim of <i>Onlinetechstores.com, Inc.</i> by Plaintiff Lexmark International, Inc.. (Shull, Jason) Modified docket text and security on 10/15/2013 (eh1). (Entered: 10/14/2013)   |
| 10/15/2013 | <u>436</u> | Clerk's ENTRY OF DEFAULT as to Defendant MBC Trading, Inc. (ba1) (Entered: 10/15/2013)  |
| 10/15/2013 | <u>437</u> | ANSWER to <u>385</u> Answer to Amended Complaint, Counterclaim of <i>Onlinetechstores.com, Inc.</i> filed by Lexmark International, Inc.. (Shull, Jason) (Entered: 10/15/2013)  |
| 10/15/2013 |            | Notice of Correction re:[FORMER DOC. 435] Reply (non motion) – Please disregard, filed using incorrect event. Counsel properly refiled as <u>437</u> Answer to Counterclaim. (eh1) (Entered: 10/15/2013)  |
| 10/15/2013 | <u>438</u> | MOTION for Entry of Stipulated Permanent Injunction and Consent Judgment by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction and Consent Judgment between Lexmark and Precision Printer) (Shull, Jason) (Entered: 10/15/2013)  |
| 10/15/2013 | <u>439</u> | Joint MOTION for Extension of Time New date requested 11/26/2013. for <i>LD Products to Answer</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 10/15/2013)   |

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| 10/15/2013 | <u>440</u> | MOTION for Leave to File <i>Sur-Reply to Second Motion to Dismiss of Defendant Impression Products</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – <i>Sur-Reply in Opposition to Impression Products Second Motion to Dismiss</i> , # <u>2</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 10/15/2013)   |
| 10/15/2013 | <u>441</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction, Consent Judgment, and Dismissal with Prejudice between Lexmark and T3 Toner LLC) (Eidem Heinze, Audra) (Entered: 10/15/2013)  |
| 10/16/2013 | <u>442</u> | ORDER granting <u>428</u> Motion for Extension of Time to Answer re <u>428</u> MOTION for Extension of Time to File Answer New date requested 12/9/2013. Interseroh Product Cycle GmbH; answer due 12/9/2013. Signed by Judge Michael R. Barrett on 10/15/13. (ba1) (Entered: 10/16/2013)   |
| 10/16/2013 | <u>443</u> | NOTICE: Please be aware that a Telephone Status Conference is set for 10/22/2013 at 03:00 PM before Judge Michael R. Barrett regarding <u>429</u> Motion for Leave to File Second Amended Complaint to Add Defendants; YOU MUST ACCESS THIS DOCUMENT TO OBTAIN CONFERENCING INFORMATION. PLEASE BE AWARE THAT YOU MUST BE LOGGED INTO CM/ECF THROUGH THE COURT'S WEBSITE (NOT PACER) USING YOUR OWN PASSWORD BEFORE RETRIEVING THIS DOCUMENT THROUGH THE NOTICE OF ELECTRONIC FILING. (ba1) (Entered: 10/16/2013) |
| 10/17/2013 | <u>444</u> | RESPONSE in Opposition re <u>405</u> MOTION to Refer the Action to Mediation filed by Defendant Onlinetechstores.com, Inc.. (Kern, David) (Entered: 10/17/2013)   |
| 10/17/2013 | <u>445</u> | RESPONSE in Opposition re <u>405</u> MOTION to Refer the Action to Mediation filed by Defendant N & L Global Co.. (Kern, David) (Entered: 10/17/2013)   |
| 10/21/2013 | <u>446</u> | ORDER granting <u>439</u> Motion for Extension of Time to Respond to <u>233</u> First Amended Complaint by LD Products until 11/26/13. Signed by Judge Michael R. Barrett on 10/21/13. (ba1) (Entered: 10/21/2013)  |
| 10/21/2013 |            | Set Deadlines/Hearings: LD Products, Inc. answer due 11/26/2013. (ba1) (Entered: 10/21/2013)  |
| 10/21/2013 | <u>447</u> | ORDER granting <u>438</u> Motion for Stipulated Permanent Injunction as to Precision Printer; granting <u>441</u> Motion for Stipulated Permanent Injunction as to T3 Toner, LLC. Signed by Judge Michael R. Barrett on 10/21/13. (ba1) (Entered: 10/21/2013)   |
| 10/21/2013 | <u>448</u> | STIPULATED PERMANENT INJUNCTION AND CONSENT JUDGMENT AS TO Precision Printer Services. Signed by Judge Michael R. Barrett on 10/21/13. (ba1) (Entered: 10/21/2013)  |
| 10/21/2013 | <u>449</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to T3 Toner, LLC. Signed by Judge Michael R. Barrett on 10/21/13. (ba1) (Entered: 10/21/2013)  |
| 10/22/2013 | <u>450</u> | RESPONSE to Motion re <u>440</u> MOTION for Leave to File <i>Sur-Reply to Second Motion to Dismiss of Defendant Impression Products</i> filed by Defendant Impression Products, Inc.. (O'Connor, Edward) (Entered: 10/22/2013)  |
| 10/22/2013 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 10/22/2013; Jason Shull appeared for Plaintiff; Glenn Bellamy appeared for Dft Blue Trading; Edward O'Connor appeared for Dft Impressions Products; David Kern appeared for Dfts Interseroh Products/Onlinetechstores, Inc., Tech Optics and NLGlobal; Order to follow on pending motions. (ba1) (Entered: 10/23/2013)   |
| 10/24/2013 | <u>451</u> | MOTION for Default Judgment against MBC Trading, Inc. by Plaintiff Lexmark International, Inc.. Responses due by 11/18/2013 (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – MBC Trading Purchase Order, # <u>3</u> Exhibit B – Declaration of Gardner (filed under seal), # <u>4</u> Exhibit C – Declaration of Breseman (filed under seal), # <u>5</u> Exhibit D – Declaration of Shull, # <u>6</u> Exhibit E – Proposed Order) (Loy, Steven) (Entered: 10/24/2013)                       |

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| 10/24/2013 | <u>452</u> | Application to Clerk for entry of default against Recyca BVBA . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Default) (Shull, Jason) (Entered: 10/24/2013)   |
| 10/24/2013 | <u>453</u> | Application to Clerk for entry of default against Eco Service China Ltd. . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Default) (Shull, Jason) (Entered: 10/24/2013)  |
| 10/24/2013 | <u>454</u> | Application to Clerk for entry of default against Enviro Green Technologies . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Default) (Shull, Jason) (Entered: 10/24/2013)   |
| 10/24/2013 | <u>455</u> | Application to Clerk for entry of default against Zhuhai Richeng Development Co., Ltd. . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Default) (Shull, Jason) (Entered: 10/24/2013)  |
| 10/24/2013 | <u>456</u> | Application to Clerk for entry of default against Shanghai Orink InfoTech International Co., Ltd. . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Default) (Shull, Jason) (Entered: 10/24/2013)   |
| 10/24/2013 | <u>457</u> | Application to Clerk for entry of default against Refiltoner . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Default) (Shull, Jason) (Entered: 10/24/2013)  |
| 10/24/2013 | <u>458</u> | Application to Clerk for entry of default against NGS S.A. . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Default) (Shull, Jason) (Entered: 10/24/2013)  |
| 10/30/2013 | <u>460</u> | ORDER granting <u>430</u> Motion to Withdraw as Attorney. Attorney Robert G Schuler terminated. Signed by Judge Michael R. Barrett on 10/30/13. (ba1) (Entered: 10/30/2013)   |
| 10/30/2013 | <u>461</u> | ORDER denying <u>405</u> Motion to Refer the Action to Mediation. Signed by Judge Michael R. Barrett on 10/30/13. (ba1) (Entered: 10/30/2013)   |
| 10/30/2013 | <u>462</u> | ORDER granting <u>429</u> Motion for Leave to File 2nd Amended Complaint; 2nd Amended Complaint Attached as Exhibit A shall be filed within 7 days of entry of this Order; Defendant answers to the 1st Amended Complaint are not required to renew upon the filing of the 2nd Amended Complaint and are deemed responsive to the 2nd Amended Complaint. Signed by Judge Michael R. Barrett on 10/30/13. (ba1) (Entered: 10/30/2013)  |
| 11/01/2013 | <u>463</u> | AMENDED COMPLAINT ( <i>Second</i> ) for Patent Infringement against Blue Trading LLC, Core Servicios Informaticos S.I., Direct Billing International Incorporated, Eco Service China Ltd., Exprint International, Inc., FBA Holding, Inc., Green Cartridge Company, Green Project, Inc., Impression Products, Inc., Interseroh Product Cycle GmbH, LD Products, Inc., MBC Trading, Inc., N & L Global Co., NGS S.A., Onlinetechstores.com, Inc., Prinko Image Co. (USA), Recyca BVBA, Refiltoner, Shanghai Orink Infotech International Co., Ltd., Tech Optics, Inc., Tesen Development (Hong Kong) Co. Ltd., Zhuhai Richeng Development Co., Ltd., Eco Service Sp. z o.o., Hock Group LLC, LTS Consumables, Inc., OW Supplies Corp., Sinotime Technologies, Inc., TonerLand, Zhuhai Aicon Image Co., Ltd., filed by Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – 9/27/11 Final Determination, # <u>2</u> Exhibit 2 – General Exclusion Order, # <u>3</u> Exhibit 3 – Laser Printer Models Chart, # <u>4</u> Exhibit 4 – '032 Patent, # <u>5</u> Exhibit 5 – '169 Patent, # <u>6</u> Exhibit 6 – '231 Patent, # <u>7</u> Exhibit 7 – '233 Patent, # <u>8</u> Exhibit 8 – '661 Patent, # <u>9</u> Exhibit 9 – '432 Patent, # <u>10</u> Exhibit 10 – '378 Patent, # <u>11</u> Exhibit 11 – '772 Patent, # <u>12</u> Exhibit 12 – '291 Patent, # <u>13</u> Exhibit 13 – '771 Patent, # <u>14</u> Exhibit 14 – '015 Patent, # <u>15</u> Exhibit 15 – '876 Patent, # <u>16</u> Exhibit 16 – '383 Patent, # <u>17</u> Exhibit 17 – '662 Patent, # <u>18</u> Exhibit 18 – '489 Patent, # <u>19</u> Exhibit 19 – '692 Patent, # <u>20</u> Exhibit 20 – '031 Patent, # <u>21</u> Exhibit 21 – '792 Patent, # <u>22</u> Exhibit 22 – '510 Patent, # <u>23</u> Exhibit 23 – '760 Patent, # <u>24</u> Exhibit 24 – '204 Patent) (Shull, Jason) (Entered: 11/01/2013) |
| 11/04/2013 | <u>464</u> | Joint MOTION for Entry of Dismissal <i>as to FBA Holdings, Inc.</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Dismissal with Prejudice) (Eidem Heinze, Audra) (Entered: 11/04/2013)  |



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| 11/04/2013 | <u>465</u> | MOTION for Entry of Stipulated Permanent Injunction and Final Judgment and Dismissal with Prejudice as to Green Project, Inc. by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction between Lexmark and Green Project, Inc., # <u>2</u> Exhibit 2 – Final Judgment and Dismissal with Prejudice) (Eidem Heinze, Audra) (Entered: 11/04/2013) |
| 11/04/2013 | <u>466</u> | NOTICE of Appearance by Glenn Dean Bellamy for Defendant Eco Service China Ltd. (Bellamy, Glenn) (Entered: 11/04/2013)  |
| 11/04/2013 | <u>467</u> | Corporate Disclosure Statement by Defendant Eco Service China Ltd.. (Bellamy, Glenn) (Entered: 11/04/2013)  |
| 11/04/2013 | <u>468</u> | MOTION for Leave to Appear Pro Hac Vice of Andre A. Gibson (Filing fee \$ 200, receipt number 0648-4326924) by Defendant Eco Service China Ltd.. (Bellamy, Glenn) (Entered: 11/04/2013)   |
| 11/05/2013 | <u>469</u> | ORDER granting <u>468</u> Motion for Leave to Appear Pro Hac Vice of Andre A. Gibson for Defendant ECO Service, China, Ltd. Signed by Judge Michael R. Barrett on 11/5/13. (ba1) (Entered: 11/05/2013)  |
| 11/05/2013 | <u>470</u> | Clerk's ENTRY OF DEFAULT as to Defendant Recyca BVBA (ba1) (Entered: 11/05/2013)  |
| 11/05/2013 | <u>471</u> | Clerk's ENTRY OF DEFAULT as to Defendant Green Cartridge Company (ba1) (Entered: 11/05/2013)  |
| 11/05/2013 | <u>472</u> | Clerk's ENTRY OF DEFAULT as to Defendant Zhuhai Richeng Development Co., Ltd. (ba1) (Entered: 11/05/2013)   |
| 11/05/2013 | <u>473</u> | Clerk's ENTRY OF DEFAULT as to Defendant Shanghai Orink Infotech International Co., Ltd. (ba1) (Entered: 11/05/2013)  |
| 11/05/2013 | <u>474</u> | Clerk's ENTRY OF DEFAULT as to Defendant Refilteroner (ba1) (Entered: 11/05/2013)   |
| 11/05/2013 | <u>475</u> | First MOTION for Extension of Time New date requested 11/25/2013. <i>to file Responsive Pleading to Complaint</i> by Defendant Eco Service China Ltd.. (Attachments: # <u>1</u> Exhibit Ex. A, # <u>2</u> Exhibit Ex. B, # <u>3</u> Text of Proposed Order Proposed Order) (Bellamy, Glenn) (Entered: 11/05/2013)   |
| 11/05/2013 | <u>476</u> | Clerk's ENTRY OF DEFAULT as to Defendant NGS S.A. (ba1) (Entered: 11/05/2013)   |
| 11/05/2013 | <u>477</u> | MOTION for Permission to Serve by Alternative Means by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit 1 – Declaration of Ronald Hanson, # <u>3</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 11/05/2013)   |
| 11/12/2013 | <u>478</u> | DISMISSAL WITH PREJUDICE granting <u>464</u> Joint MOTION for Entry of Dismissal <i>as to FBA Holdings, Inc.</i> filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 11/8/13. (ba1) (Entered: 11/12/2013)  |
| 11/12/2013 | <u>479</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE; Green Project, Inc. terminated. Signed by Judge Michael R. Barrett on 11/8/13. (ba1) (Entered: 11/12/2013)   |
| 11/12/2013 | <u>480</u> | STIPULATED PERMANENT INJUNCTION as to Green Project, Inc. Signed by Judge Michael R. Barrett on 11/8/13. (ba1) (Entered: 11/12/2013)  |
| 11/13/2013 | <u>481</u> | Summons Issued as to Hock Group LLC, LTS Consumables, Inc., OW Supplies Corp., Sinotime Technologies, Inc., TonerLand. (lk) (Entered: 11/13/2013)   |
| 11/15/2013 | <u>482</u> | Unopposed MOTION for Extension of Time to File Answer re <u>463</u> Amended Complaint,,,,,, New date requested 12/16/2013. by Defendant Tech Optics, Inc.. (Kern, David) (Entered: 11/15/2013)  |
| 11/19/2013 | <u>483</u> | ORDER granting <u>482</u> Motion for Extension of Time to Answer re <u>463</u> Second Amended Complaint; Tech Optics, Inc. answer due 12/16/2013. Signed by Judge Michael R. Barrett on 11/19/13. (ba1) (Entered: 11/19/2013)   |

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| 11/20/2013 | <u>484</u> | ANSWER with Jury Demand to <u>463</u> Amended Complaint, COUNTERCLAIM against Lexmark International, Inc. filed by Onlinetechstores.com, Inc.. (Kern, David) Modified docket text on 11/21/2013 (eh1). (Entered: 11/20/2013)  |
| 11/25/2013 | <u>485</u> | NOTICE by Defendant Impression Products, Inc. of <i>Additional Authority Regarding its Motion to Dismiss Re Jazz Photo</i> (Attachments: # <u>1</u> Exhibit A) (O'Connor, Edward) (Entered: 11/25/2013)   |
| 11/25/2013 | <u>486</u> | MOTION to Dismiss , MOTION to Dismiss for Lack of Jurisdiction ( Responses due by 12/19/2013) by Defendant Eco Service China Ltd.. (Attachments: # <u>1</u> Exhibit 1, # <u>2</u> Exhibit 2, # <u>3</u> Text of Proposed Order) (Gibson, Andre) (Entered: 11/25/2013)   |
| 11/26/2013 | <u>487</u> | NOTICE of Appearance by Karl Stephen Kronenberger for Defendant LD Products, Inc. (Kronenberger, Karl) (Entered: 11/26/2013)  |
| 11/26/2013 | <u>488</u> | Response re <u>485</u> Notice (Other) of <i>Additional Authority</i> by Plaintiff Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 11/26/2013)  |
| 11/26/2013 | <u>489</u> | MOTION for Leave to Appear Pro Hac Vice of Marc N. Bernstein, Will B. Fitton (Filing fee \$ 400, receipt number 0648-4355489) by Defendant LD Products, Inc.. (Attachments: # <u>1</u> Certificate of Good Standing for Mr. Bernstein, # <u>2</u> Certificate of Good Standing for Mr. Fitton) (Kronenberger, Karl) (Entered: 11/26/2013) |
| 11/26/2013 | <u>490</u> | ANSWER to <u>463</u> Amended Complaint filed by LD Products, Inc.. (Kronenberger, Karl) Modified docket text on 11/27/2013 (eh1). (Entered: 11/26/2013)   |
| 11/27/2013 | <u>491</u> | Reply re <u>488</u> Response (non motion) to the <i>Notice of Additional Authority</i> by Defendant Impression Products, Inc.. (O'Connor, Edward) (Entered: 11/27/2013)   |
| 11/27/2013 | <u>492</u> | ORDER granting <u>489</u> Motion for Leave to Appear Pro Hac Vice of Marc N. Berstein and will B. Fitton for Defendant LD Products, Inc.. Signed by Judge Michael R. Barrett on 11/27/13. (ba1) (Entered: 11/27/2013)   |
| 11/27/2013 | <u>493</u> | Corporate Disclosure Statement by Defendant LD Products, Inc.. (Kronenberger, Karl) (Entered: 11/27/2013)   |
| 12/02/2013 | <u>494</u> | ORDER granting <u>477</u> Motion for Permission for Alternate Service. Signed by Judge Michael R. Barrett on 12/2/13. (ba1) (Entered: 12/02/2013)   |
| 12/03/2013 | <u>495</u> | SUMMONS Returned Executed as to Defendant TonerLand. TonerLand served on 11/18/2013, answer due 12/9/2013. (Shull, Jason) (Entered: 12/03/2013)   |
| 12/03/2013 | <u>496</u> | SUMMONS Returned Executed as to Defendant OW Supplies Corp.. OW Supplies Corp. served on 11/18/2013, answer due 12/9/2013. (Shull, Jason) (Entered: 12/03/2013)   |
| 12/03/2013 | <u>497</u> | SUMMONS Returned Executed as to Defendant Hock Group LLC. Hock Group LLC served on 11/19/2013, answer due 12/10/2013. (Shull, Jason) (Entered: 12/03/2013)  |
| 12/03/2013 | <u>498</u> | SUMMONS Returned Executed as to Defendant LTS Consumables, Inc.. LTS Consumables, Inc. served on 11/19/2013, answer due 12/10/2013. (Shull, Jason) (Entered: 12/03/2013)  |
| 12/05/2013 | <u>499</u> | SUMMONS Returned Executed as to Defendant Sinotime Technologies, Inc.. Sinotime Technologies, Inc. served on 11/21/2013, answer due 12/12/2013. (Shull, Jason) (Entered: 12/05/2013)  |
| 12/06/2013 | <u>500</u> | STIPULATION for <i>Extension of Time to Answer, Move or Otherwise Plead</i> by Defendant TonerLand, Plaintiff Lexmark International, Inc. (Foley, Michael) Modified on 12/9/2013 (eh1). (Entered: 12/06/2013)   |
| 12/09/2013 |            | Set Deadlines/Hearings: TonerLand answer due 12/30/2013. (eh1) (Entered: 12/09/2013)  |
| 12/09/2013 | <u>501</u> | Summons Issued as to Eco Service Sp. z o.o., Zhuhai Aicon Image Co., Ltd.. (eh1) (Entered: 12/09/2013)  |

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| 12/09/2013 | <u>502</u> | MOTION for Extension of Time to File Answer re <u>463</u> Amended Complaint,,,,,, New date requested 12/23/2013. by Defendant Interseroh Product Cycle GmbH. (Kern, David) (Entered: 12/09/2013)   |
| 12/09/2013 | <u>503</u> | NOTICE of Appearance by David Graham Kern for Defendant OW Supplies Corp. (Kern, David) (Entered: 12/09/2013)  |
| 12/09/2013 | <u>504</u> | Corporate Disclosure Statement by Defendant OW Supplies Corp.. (Kern, David) (Entered: 12/09/2013)   |
| 12/09/2013 | <u>505</u> | ANSWER to <u>463</u> Amended Complaint,,,,,, , COUNTERCLAIM against Lexmark International, Inc. filed by OW Supplies Corp.. (Kern, David) (Entered: 12/09/2013)  |
| 12/10/2013 | <u>506</u> | Unopposed MOTION for Extension of Time New date requested 1/3/2014. <i>to respond to Defendant Eco Service China, Ltd.s Motion to Dismiss</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 12/10/2013)   |
| 12/10/2013 | <u>507</u> | MOTION for Default Judgment against Shanghai Orink InfoTech International Co., Ltd. by Plaintiff Lexmark International, Inc.. Responses due by 1/3/2014 (Attachments: # <u>1</u> Exhibit A – Declaration of Gardner, # <u>2</u> Exhibit B – Declaration of Breseman (File Under Seal), # <u>3</u> Exhibit C – Declaration of Shull (Filed Under Seal), # <u>4</u> Exhibit D – Proposed Order) (Shull, Jason) (Entered: 12/10/2013)             |
| 12/10/2013 | <u>508</u> | MOTION for Default Judgment against Zhuhai Richeng Development Co., Ltd. by Plaintiff Lexmark International, Inc.. Responses due by 1/3/2014 (Attachments: # <u>1</u> Exhibit A – Declaration of Gardner, # <u>2</u> Exhibit B – Declaration of Breseman (File Under Seal), # <u>3</u> Exhibit C – Declaration of Shull (Filed Under Seal), # <u>4</u> Exhibit D – Proposed Order) (Shull, Jason) (Entered: 12/10/2013)                        |
| 12/10/2013 | <u>509</u> | MOTION for Default Judgment against Recyca BVBA by Plaintiff Lexmark International, Inc.. Responses due by 1/3/2014 (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – Declaration of Gardner, # <u>3</u> Exhibit B – Declaration of Breseman (File Under Seal), # <u>4</u> Exhibit C – Declaration of Shull (Filed Under Seal), # <u>5</u> Exhibit D – Proposed Order) (Shull, Jason) (Entered: 12/10/2013)               |
| 12/10/2013 | <u>510</u> | MOTION for Default Judgment against Refilterner by Plaintiff Lexmark International, Inc.. Responses due by 1/3/2014 (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – Declaration of Gardner, # <u>3</u> Exhibit B – Declaration of Breseman (File Under Seal), # <u>4</u> Exhibit C – Declaration of Shull (Filed Under Seal), # <u>5</u> Exhibit D – Proposed Order) (Shull, Jason) (Entered: 12/10/2013)               |
| 12/10/2013 | <u>511</u> | MOTION for Default Judgment against NGS S.A. by Plaintiff Lexmark International, Inc.. Responses due by 1/3/2014 (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – Declaration of Gardner, # <u>3</u> Exhibit B – Declaration of Breseman (File Under Seal), # <u>4</u> Exhibit C – Declaration of Shull (Filed Under Seal), # <u>5</u> Exhibit D – Proposed Order) (Shull, Jason) (Entered: 12/10/2013)                  |
| 12/10/2013 | <u>512</u> | MOTION for Default Judgment against Enviro Green Technologies by Plaintiff Lexmark International, Inc.. Responses due by 1/3/2014 (Attachments: # <u>1</u> Memorandum in Support, # <u>2</u> Exhibit A – Declaration of Gardner, # <u>3</u> Exhibit B – Declaration of Breseman (File Under Seal), # <u>4</u> Exhibit C – Declaration of Shull (Filed Under Seal), # <u>5</u> Exhibit D – Proposed Order) (Shull, Jason) (Entered: 12/10/2013) |
| 12/10/2013 | <u>513</u> | NOTICE by Plaintiff Lexmark International, Inc. re <u>507</u> MOTION for Default Judgment against Shanghai Orink InfoTech International Co., Ltd. <i>Memorandum in Support of MOTION for Default Judgment against Shanghai Orink InfoTech International Co., Ltd.</i> (Shull, Jason) (Entered: 12/10/2013)   |
| 12/10/2013 | <u>514</u> | NOTICE by Plaintiff Lexmark International, Inc. re <u>508</u> MOTION for Default Judgment against Zhuhai Richeng Development Co., Ltd. <i>Memorandum in Support of MOTION for Default Judgment against Zhuhai Richeng Development Co., Ltd.</i> (Shull, Jason) (Entered: 12/10/2013)   |
| 12/11/2013 | <u>516</u> | STIPULATION FOR EXTENSION OF TIME TO ANSWER, MOVE OR OTHERWISE PLEAD by Defendant Sinotime Technologies, Inc.. (Gatlin, Jack)  |

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|            |            | (Entered: 12/11/2013)  |
| 12/12/2013 |            | Set/Reset Deadlines: Sinotime Technologies, Inc. answer due 12/30/2013. (jlw) (Entered: 12/12/2013)  |
| 12/12/2013 | <u>522</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice <i>with Respect to Blue Trading</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Proposed Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice) (Eidem Heinze, Audra) (Entered: 12/12/2013) |
| 12/12/2013 | <u>523</u> | STIPULATION for Extension of Time for Defendant Hock Group LLC to Answer, Move or Otherwise Plead by Plaintiff Lexmark International, Inc.. (Shull, Jason) (Entered: 12/12/2013)   |
| 12/16/2013 | <u>524</u> | NOTICE of Appearance by Jack S. Gatlin for Defendant Sinotime Technologies, Inc. (Gatlin, Jack) (Entered: 12/16/2013)  |
| 12/16/2013 | <u>525</u> | MOTION for Leave to Appear Pro Hac Vice of Hongwei Shang by Defendant Sinotime Technologies, Inc.. (Gatlin, Jack) Modified docket text on 12/17/2013 (eh1). (Entered: 12/16/2013)  |
| 12/16/2013 | <u>526</u> | ORDER granting <u>506</u> Motion for Extension of Time until 1/3/14 to respond to Defendant Eco Service China, Ltd's <u>486</u> Motion to Dismiss. Signed by Judge Michael R. Barrett on 12/15/13. (ba1) (Entered: 12/16/2013)   |
| 12/16/2013 | <u>527</u> | Reply re <u>484</u> Answer to Amended Complaint, Counterclaim of <i>OnlineTechStores.com, Inc.</i> by Plaintiff Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 12/16/2013)   |
| 12/17/2013 | <u>528</u> | ANSWER to <u>484</u> Answer to Amended Complaint, Counterclaim of <i>OnlineTechStores.com, Inc.</i> filed by Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 12/17/2013)  |
| 12/17/2013 | <u>529</u> | SUMMONS Returned Executed as to Defendant Eco Service Sp. z o.o.. Eco Service Sp. z o.o. served on 12/12/2013, answer due 1/2/2014. (Shull, Jason) (Entered: 12/17/2013)   |
| 12/17/2013 | <u>530</u> | SUMMONS Returned Executed as to Defendant Zhuhai Aicon Image Co., Ltd.. Zhuhai Aicon Image Co., Ltd. served on 12/12/2013, answer due 1/2/2014. (Shull, Jason) (Entered: 12/17/2013)   |
| 12/19/2013 | <u>531</u> | ORDER granting <u>502</u> Motion for Extension of Time to Answer re <u>463</u> Amended Complaint; Interseroh Product Cycle GmbH answer due 12/23/2013. Signed by Judge Michael R. Barrett on 12/18/13. (ba1) (Entered: 12/19/2013)   |
| 12/19/2013 | <u>532</u> | ANSWER to <u>505</u> Answer to Amended Complaint, Counterclaim of <i>OW Supplies Corp.</i> filed by Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 12/19/2013)   |
| 12/20/2013 | <u>533</u> | ANSWER to <u>463</u> Amended Complaint,,,,,, filed by Sinotime Technologies, Inc.. (Gatlin, Jack) (Entered: 12/20/2013)  |
| 12/20/2013 | <u>534</u> | STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND DISMISSAL WITH PREJUDICE as to Blue Trading, LLC. Signed by Judge Michael R. Barrett on 12/20/13. (ba1) (Entered: 12/20/2013)   |
| 12/20/2013 | <u>535</u> | ORDER granting <u>475</u> Motion for Extension of Time to File a Responsive Pleading; <u>486</u> Motion to Dismiss is deemed properly filed; <u>453</u> is deemed MOOT and default will not be entered against Eco Service, China Ltd. Signed by Judge Michael R. Barrett on 12/20/13. (ba1) (Entered: 12/20/2013)                             |
| 12/23/2013 | <u>536</u> | NOTICE of Appearance by Daniel William Wolff for Defendant Recyca BVBA (Wolff, Daniel) (Entered: 12/23/2013)   |
| 12/23/2013 | <u>537</u> | Unopposed MOTION for Extension of Time to File Answer New date requested 1/20/2014. by Defendant Interseroh Product Cycle GmbH. (Kern, David) (Entered: 12/23/2013)  |



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| 12/26/2013 |            | NOTICE of Hearing on Motion re <u>510</u> MOTION for Default Judgment against Refilterner, <u>507</u> MOTION for Default Judgment against Shanghai Orink InfoTech International Co., Ltd., <u>512</u> MOTION for Default Judgment against Enviro Green Technologies, <u>451</u> MOTION for Default Judgment against MBC Trading, Inc., <u>509</u> MOTION for Default Judgment against Recyca BVBA, <u>419</u> MOTION for Default Judgment against Prinko Image Co. (USA), Inc., <u>511</u> MOTION for Default Judgment against NGS S.A., <u>508</u> MOTION for Default Judgment against Zhuhai Richeng Development Co., Ltd.; Please be aware that a Motion Hearing set for 1/6/2014 at 10:00 AM in Courtroom 109 – Cincinnati before Judge Michael R. Barrett; Plaintiff's Counsel is responsible for notifying the Defendants of the date and time of this setting. (ba1) (Entered: 12/26/2013) |
| 12/26/2013 |            | PHV (Hongwei Shang) Filing fee: \$ 200.00, receipt number 100CIN020788 (lk) (Entered: 12/26/2013)   |
| 12/27/2013 | <u>538</u> | Application to Clerk for entry of default against Core Servicios Informaticos S.I. . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Entry of Default) (Eidem Heinze, Audra) (Entered: 12/27/2013)  |
| 12/30/2013 | <u>539</u> | Joint MOTION for Extension of Time to File Answer New date requested 1/30/2014. by Plaintiff Lexmark International, Inc. and by Defendant TonerLand. (Foley, Michael) (Entered: 12/30/2013)   |
| 12/30/2013 | <u>540</u> | MOTION for Leave to Appear Pro Hac Vice of Andre A. Gibson (Filing fee \$ 200, receipt number 0648-4389841) by Defendant Eco Service Sp. z o.o.. (Bellamy, Glenn) (Entered: 12/30/2013)   |
| 12/30/2013 | <u>541</u> | Corporate Disclosure Statement by Defendants Eco Service Sp. z o.o., Black Point S.A. identifying Corporate Parent Black Point S.A. for Eco Service Sp. z o.o... (Bellamy, Glenn) (Entered: 12/30/2013)   |
| 12/30/2013 | <u>542</u> | AMENDED DOCUMENT by Defendant Eco Service Sp. z o.o.. Amendment to <u>541</u> Corporate Disclosure Statement . (Bellamy, Glenn) (Entered: 12/30/2013)   |
| 12/30/2013 | <u>543</u> | Unopposed MOTION for Extension of Time to File Response/Reply as to <u>463</u> Amended Complaint,,,,,, New date requested 2/3/2014. by Defendant Eco Service Sp. z o.o.. (Attachments: # <u>1</u> Text of Proposed Order) (Bellamy, Glenn) (Entered: 12/30/2013)  |
| 12/30/2013 | <u>544</u> | MOTION for Leave to Appear Pro Hac Vice of Brian M. Koide (Filing fee \$ 200) by Defendant Recyca BVBA. (Wolff, Daniel) (Entered: 12/30/2013)   |
| 12/31/2013 |            | Filing fee re <u>544</u> : \$ 200, receipt number 0648-4391642. (Wolff, Daniel) (Entered: 12/31/2013)   |
| 01/02/2014 | <u>545</u> | ORDER granting <u>525</u> Motion for Leave to Appear Pro Hac Vice of Hongwei Shang for Defendant Sinotime Technologies, Inc.. Signed by Judge Michael R. Barrett on 12/31/13. (ba1) (Entered: 01/02/2014)   |
| 01/02/2014 | <u>546</u> | Corporate Disclosure Statement by Defendant Recyca BVBA. (Wolff, Daniel) (Entered: 01/02/2014)  |
| 01/02/2014 | <u>547</u> | Unopposed MOTION for Extension of Time New date requested 1/17/2014. for Lexmark to respond to Defendant Eco Service China, Ltd.s (Eco Services) Motion to Dismiss by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 01/02/2014)   |
| 01/03/2014 | <u>548</u> | NOTICE of Voluntary Dismissal of Defendant Eco Service China, Ltd. by Plaintiff Lexmark International, Inc. (Eidem Heinze, Audra) Modified docket text on 1/6/2014 (eh1). (Entered: 01/03/2014)   |
| 01/03/2014 | <u>549</u> | ORDER granting <u>537</u> Motion for Extension of Time to Answer re <u>463</u> Amended Complaint; Interseroh Product Cycle GmbH answer due 1/20/2014. Signed by Judge Michael R. Barrett on 1/3/14. (ba1) (Entered: 01/03/2014)   |
| 01/03/2014 | <u>550</u> | ORDER granting <u>543</u> Unopposed MOTION for Extension of Time to File Response/Reply as to <u>463</u> Amended Complaint; Eco Service Sp. z o.o. answer due 2/3/2014. Signed by Judge Michael R. Barrett on 1/3/14. (ba1) (Entered: 01/03/2014)   |

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| 01/03/2014 | <u>551</u> | ORDER granting <u>539</u> Motion for Extension of Time to Answer re <u>463</u> Amended Complaint; TonerLand answer due 1/30/2014. Signed by Judge Michael R. Barrett on 1/3/14. (ba1) (Entered: 01/03/2014)  |
| 01/03/2014 | <u>552</u> | MOTION to Set Aside <u>470</u> Clerk's Entry of Default and <i>Opposition to Plaintiff's Motion for Default Judgment</i> <u>509</u> by Defendant Recyca BVBA. (Attachments: # <u>1</u> Memorandum In Support, # <u>2</u> Exhibit A – Declaration of Weyde, # <u>3</u> Exhibit B, # <u>4</u> Exhibit C, # <u>5</u> Exhibit D, # <u>6</u> Text of Proposed Order) (Wolff, Daniel) (Entered: 01/03/2014)  |
| 01/06/2014 | <u>553</u> | Minute Entry for proceedings held before Judge Michael R. Barrett: Motion Hearing held on 1/6/2014 re <u>419</u> MOTION for Default Judgment against Prinko Image Co. (USA), Inc. filed by Lexmark International, Inc., <u>511</u> MOTION for Default Judgment against NGS S.A. filed by Lexmark International, Inc., <u>512</u> MOTION for Default Judgment against Enviro Green Technologies filed by Lexmark International, Inc., <u>508</u> MOTION for Default Judgment against Zhuhai Richeng Development Co., Ltd. filed by Lexmark International, Inc., <u>451</u> MOTION for Default Judgment against MBC Trading, Inc. filed by Lexmark International, Inc., <u>509</u> MOTION for Default Judgment against Recyca BVBA filed by Lexmark International, Inc., <u>510</u> MOTION for Default Judgment against Refilterner filed by Lexmark International, Inc., <u>507</u> MOTION for Default Judgment against Shanghai Orink InfoTech International Co., Ltd. filed by Lexmark International, Inc; Counsel present; <u>509</u> found to be moot – order to follow; Docs heard: <u>419</u> , <u>451</u> , <u>507</u> , <u>508</u> , <u>510</u> , <u>511</u> , and <u>512</u> – orders to follow; Hearing set for 3/27/2014 at 09:30 AM in Courtroom 109 – Cincinnati before Judge Michael R. Barrett in anticipation of jurisdictional motions to be filed. (Court Reporter Maryann Maffia, Official.) (ba1) (Entered: 01/06/2014) |
| 01/06/2014 | <u>554</u> | ORDER granting <u>540</u> Motion for Leave to Appear Pro Hac Vice of Andre A. Gibson for Defendant Eco Service, Sp.z.o.o.. Signed by Judge Michael R. Barrett on 1/6/14. (ba1) (Entered: 01/06/2014)   |
| 01/06/2014 | <u>555</u> | ORDER granting <u>544</u> Motion for Leave to Appear Pro Hac Vice of Brian M. Koide for Defendant, Recyca BVBA. Signed by Judge Michael R. Barrett on 1/6/14. (ba1) (Entered: 01/06/2014)  |
| 01/08/2014 | <u>556</u> | ORDER FOR DEFAULT JUDGMENT granting <u>419</u> MOTION for Default Judgment against Prinko Image Co. (USA), Inc filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 1/8/14. (ba1) (Entered: 01/08/2014)  |
| 01/08/2014 | <u>557</u> | ORDER FOR DEFAULT JUDGMENT granting <u>451</u> MOTION for Default Judgment against MBC Trading, Inc. filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 1/8/14. (ba1) (Entered: 01/08/2014)  |
| 01/08/2014 | <u>558</u> | ORDER FOR DEFAULT JUDGMENT granting <u>507</u> MOTION for Default Judgment against Shanghai Orink InfoTech International Co., Ltd. filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 1/7/14. (ba1) (Entered: 01/08/2014)  |
| 01/08/2014 | <u>559</u> | ORDER FOR DEFAULT JUDGMENT granting <u>508</u> MOTION for Default Judgment against Zhuhai Richeng Development Co., Ltd. filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 1/7/14. (ba1) (Entered: 01/08/2014)   |
| 01/08/2014 | <u>560</u> | ORDER FOR DEFAULT JUDGMENT granting <u>510</u> MOTION for Default Judgment against Refilterner filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 1/7/14. (ba1) (Entered: 01/08/2014)  |
| 01/08/2014 | <u>561</u> | ORDER FOR DEFAULT JUDGMENT granting <u>511</u> MOTION for Default Judgment against NGS S.A. filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 1/7/14. (ba1) (Entered: 01/08/2014)   |
| 01/08/2014 | <u>562</u> | ORDER FOR DEFAULT JUDGMENT granting <u>512</u> MOTION for Default Judgment against Enviro Green Technologies filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 1/7/14. (ba1) (Entered: 01/08/2014)  |
| 01/08/2014 | <u>563</u> | ORDER re <u>548</u> Notice of Voluntary Dismissal filed by Lexmark International, Inc. terminating Eco Service China Ltd. finding as moot <u>486</u> MOTION to Dismiss   |

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|            |            | MOTION to Dismiss for Lack of Jurisdiction filed by Eco Service China Ltd. Signed by Judge Michael R. Barrett on 1/8/14. (ba1) (Entered: 01/08/2014)   |
| 01/09/2014 | <u>564</u> | STIPULATION <i>Relating to: (1) Lexmark's Motion for Default Judgment Against Recyca [ECF 509], and (2) Recyca's Motion to Set Aside Entry of Default [ECF 552]</i> by Plaintiff Lexmark International, Inc.. (Shull, Jason) (Entered: 01/09/2014)   |
| 01/16/2014 | <u>565</u> | MOTION for Entry of Stipulated Permanent Injunction and Final Judgment and Dismissal with Prejudice as to LTS Consumables by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit 1 – Stipulated Permanent Injunction between Lexmark and LTS Consumables, # <u>2</u> Exhibit 2 – Final Judgment and Dismissal with Prejudice) (Eidem Heinze, Audra) (Entered: 01/16/2014)  |
| 01/20/2014 | <u>566</u> | MOTION to Dismiss for Lack of Jurisdiction by Defendant Interseroh Product Cycle GmbH. Responses due by 2/13/2014 (Attachments: # <u>1</u> Affidavit Affidavit of Andreas Klaus Schelle) (Kern, David) (Entered: 01/20/2014)   |
| 01/22/2014 | <u>567</u> | ORDER granting <u>552</u> MOTION to Set Aside <u>470</u> Clerk's Entry of Default; withdrawing <u>509</u> MOTION for Default Judgment against Recyca BVBA filed by Lexmark International, Inc.; Recyca BVBA answer re <u>463</u> Amended Complaint due 2/3/2014. Signed by Judge Michael R. Barrett on 1/22/14. (ba1) (Entered: 01/22/2014)  |
| 01/22/2014 | <u>568</u> | STIPULATED PERMANENT INJUNCTION as to LTS Consumables. Signed by Judge Michael R. Barrett on 1/22/14. (ba1) Modified docket text on 1/23/2014 (eh). (Entered: 01/22/2014)  |
| 01/22/2014 | <u>569</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE as to LTS Consumables. Signed by Judge Michael R. Barrett on 1/21/14. (ba1) (Entered: 01/22/2014)  |
| 01/23/2014 | <u>570</u> | Clerk's ENTRY OF DEFAULT as to Defendant Core Servicios Informaticos S.I. (ba1) (Entered: 01/23/2014)  |
| 01/27/2014 | <u>571</u> | MOTION for Default Judgment against Core Servicios Informaticos S.I. and Memorandum in Support by Plaintiff Lexmark International, Inc.. Responses due by 2/21/2014 (Attachments: # <u>1</u> Exhibits to the Memorandum in Support, # <u>2</u> Text of Proposed Order) (Shull, Jason) (Entered: 01/27/2014)  |
| 01/30/2014 | <u>573</u> | Joint MOTION for Extension of Time New date requested 2/27/2014. <i>by Plaintiff, Lexmark and by Defendant TonerLand.</i> (Foley, Michael) (Entered: 01/30/2014)   |
| 01/31/2014 | <u>574</u> | Joint MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal with Prejudice <i>with Respect to TonerLand</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex. 1 – Proposed Stipulated Permanent Injunction, # <u>2</u> Ex. 2 – Proposed Final Judgment and Dismissal with Prejudice) (Shull, Jason) (Entered: 01/31/2014)   |
| 02/03/2014 | <u>575</u> | Joint MOTION for Extension of Time New date requested 2/21/2014. <i>and Briefing Schedule for Rule 12 Motions</i> by Defendant Eco Service Sp. z o.o.. (Bellamy, Glenn) (Entered: 02/03/2014)  |
| 02/06/2014 | <u>576</u> | MOTION to Withdraw <u>425</u> Motion for Contempt <i>against Direct Billing for Violation of This Court's Permanent Injunction Order</i> MOTION for Default Judgment against Direct Billing by Plaintiff Lexmark International, Inc.. (Shull, Jason) (Entered: 02/06/2014)   |
| 02/06/2014 | <u>577</u> | Motion for Contempt <i>against Direct Billing and Michael Gardner for Violation of This Court's Permanent Injunction Order (Memorandum filed under seal)</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Exhibit A – Bankruptcy Order, # <u>2</u> Exhibit B – Gardner Declaration (filed under seal), # <u>3</u> Exhibit C – Reinholtz Declaration, Part 1, # <u>4</u> Exhibit C – Reinholtz Declaration, Part 2, # <u>5</u> Exhibit C – Reinholtz Declaration, Part 3, # <u>6</u> Exhibit C – Reinholtz Declaration, Part 4, # <u>7</u> Exhibit C – Reinholtz Declaration, Part 5, # <u>8</u> Exhibit C – Reinholtz Declaration, Part 6, # <u>9</u> Exhibit C – Reinholtz Declaration, Part 7, # <u>10</u> Exhibit D – Breseman Declaration (filed under seal), # <u>11</u> Exhibit E – Cease and Desist Order, # <u>12</u> Exhibit F – Shull Declaration, # <u>13</u> Exhibit G – Settlement Agreement (filed under seal), # <u>14</u> Text of Proposed Order) (Shull, Jason) (Entered: 02/06/2014) |

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| 02/06/2014 | <u>578</u> | MOTION for Default Judgment against Direct Billing and Memorandum in Support by Plaintiff Lexmark International, Inc.. Responses due by 3/3/2014 (Attachments: # <u>1</u> Exhibit A – Gardner Declaration (filed under seal), # <u>2</u> Exhibit B – Breseman Declaration (filed under seal), # <u>3</u> Exhibit C – Shull Declaration, # <u>4</u> Text of Proposed Order) (Shull, Jason) (Entered: 02/06/2014)  |
| 02/11/2014 | <u>581</u> | ORDER granting <u>575</u> Joint MOTION for Extension of Time <i>and Briefing Schedule for Rule 12 Motions</i> filed by Eco Service Sp. z o.o.; 2/21/14 deadline for Eco Service Poland and Recyca to respond to <u>463</u> Second Amended Complaint including the filing of any Rule 12 motions; 3/17/14 deadline for Lexmark to file oppositions to any Rule 12 motions filed by Interseroh, Eco Service Poland and Recyca; 3/31/14 deadline for Interseroh, Eco Service Poland and Recyca to file their replies to any Rule 12 motions; the Motion hearing set for 3/27/14 is CONVERTED to a Status Conference and will remain set for 3/27/2014 at 09:30 AM and will be conducted by teleconference before Judge Michael R. Barrett. Signed by Judge Michael R. Barrett on 2/11/14. (ba1) (Entered: 02/11/2014) |
| 02/13/2014 | <u>582</u> | MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies <i>And Memorandum in Support</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Declaration of Audra C. Eidem Heinze, # <u>2</u> Declaration of Timothy C. Meece, # <u>3</u> Declaration of Jason S. Shull (filed under seal), # <u>4</u> Declaration of Ronald Hanson, # <u>5</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 02/13/2014)  |
| 02/17/2014 | <u>584</u> | Application to Clerk for entry of default against Zhuhai Aicon Image Co, Ltd. . (Attachments: # <u>1</u> Declaration of Jason S. Shull, # <u>2</u> Text of Proposed Order) (Shull, Jason) (Entered: 02/17/2014)  |
| 02/18/2014 | <u>585</u> | Clerk's ENTRY OF DEFAULT as to Defendant Zhuhai Aicon Image Co., Ltd. (ba1) (Entered: 02/18/2014)  |
| 02/19/2014 | <u>586</u> | ORDER TO SHOW CAUSE; Show Cause Response due 7 days from the filing of this Order. Signed by Judge Michael R. Barrett on 2/19/14. (ba1) (Entered: 02/19/2014)  |
| 02/19/2014 | <u>587</u> | STIPULATED PERMANENT INJUNCTION AS TO Tonerland. Signed by Judge Michael R. Barrett on 2/17/14. (ba1) (Entered: 02/19/2014)  |
| 02/19/2014 | <u>588</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE as to TonerLand. Signed by Judge Michael R. Barrett on 2/19/14. (ba1) (Entered: 02/19/2014)  |
| 02/19/2014 | <u>589</u> | ORDER finding as moot <u>573</u> Motion for Extension of Time to Answer as to TonerLand. Signed by Judge Michael R. Barrett on 2/19/14. (ba1) (Entered: 02/19/2014)  |
| 02/20/2014 | <u>590</u> | MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal with Prejudice <i>with respect to Hock Group, LLC.</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> x. 1 – Proposed Stipulated Permanent Injunction, # <u>2</u> Ex. 2 – Proposed Final Judgment and Dismissal with Prejudice) (Shull, Jason) (Entered: 02/20/2014)   |
| 02/21/2014 | <u>591</u> | MOTION to Dismiss <i>For Lack Of Subject Matter Jurisdiction, For Lack Of Personal Jurisdiction, Improper Venue, For Failure To State A Claim, Or In The Alternative A Motion For Summary Judgment And Incorporated Memorandum Of Law</i> by Defendant Eco Service Sp. z o.o.. Responses due by 3/17/2014 (Attachments: # <u>1</u> Exhibit 1 – Declaration of Adamski, # <u>2</u> Exhibit 2 – Centrafarm v. Sterling Drug 15–74) (Bellamy, Glenn) (Entered: 02/21/2014)  |
| 02/21/2014 | <u>592</u> | NOTICE of Appearance by Glenn Dean Bellamy for Defendant Core Servicios Informaticos S.I. (Bellamy, Glenn) (Entered: 02/21/2014)   |
| 02/21/2014 | <u>593</u> | Corporate Disclosure Statement by Defendant Core Servicios Informaticos S.I.. (Bellamy, Glenn) (Entered: 02/21/2014)   |
| 02/21/2014 | <u>594</u> | MOTION for Entry of Stipulated Permanent Injunction, Consent Judgment and Dismissal with Prejudice <i>with respect to Recyca BVBA</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex. 1 – Proposed Stipulated Permanent   |



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|            |            | Injunction, # <u>2</u> Ex. 2 – Proposed Judgment and Dismissal with Prejudice) (Shull, Jason) (Entered: 02/21/2014)  |
| 02/24/2014 | <u>595</u> | NOTICE by Plaintiff Lexmark International, Inc. of <i>Supplement to Certificate of Service to Motion to Institute Contempt Proceedings to Determine Violation of Permanent Injunction Order by Benigno Adeva and His Companies</i> (Eidem Heinze, Audra) (Entered: 02/24/2014)   |
| 02/24/2014 | <u>596</u> | Joint MOTION to Set Aside re <u>570</u> Clerk's Entry of Default <i>Against Core Servicios and Stipulation Regarding Core Servicios Response to Lexmarks Second Amended Complaint</i> by Plaintiff Lexmark International, Inc.. (Shull, Jason) (Entered: 02/24/2014)   |
| 02/25/2014 | <u>597</u> | MOTION for Entry of Stipulated Permanent Injunction and Dismissal with Prejudice with respect to <i>OnlineTechStores.com, Inc.</i> by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex. 1 – Proposed Stipulated Permanent Injunction and Dismissal) (Shull, Jason) (Entered: 02/25/2014)   |
| 02/26/2014 | <u>598</u> | MOTION for Default Judgment against Zhuhai Aicon Image Co. Ltd. and Memorandum in Support by Plaintiff Lexmark International, Inc.. Responses due by 3/24/2014 (Attachments: # <u>1</u> Exhibit A – Gardner Declaration (file under seal), # <u>2</u> Exhibit B – Breseman Declaration (file under seal), # <u>3</u> Exhibit C – Shull Declaration, # <u>4</u> Exhibit D – Text of Proposed Order) (Shull, Jason) (Entered: 02/26/2014)  |
| 02/28/2014 | <u>600</u> | MOTION for Leave to Appear Pro Hac Vice of Andre A. Gibson (Filing fee \$ 200, receipt number 0648–4465663) by Defendant Core Servicios Informaticos S.I.. (Attachments: # <u>1</u> Certificate of Good Standing, # <u>2</u> Order Granting Motion for Admission) (Bellamy, Glenn) (Entered: 02/28/2014)   |
| 03/03/2014 | <u>601</u> | MOTION to Dismiss <i>For Lack Of Subject Matter Jurisdiction, For Lack Of Personal Jurisdiction, Improper Venue, For Failure To State A Claim, Or In The Alternative A Motion For Summary Judgment And Incorporated Memorandum Of Law</i> by Defendant Core Servicios Informaticos S.I.. Responses due by 3/27/2014 (Attachments: # <u>1</u> Exhibit 1 – Declaration of Mr. Pablo Conde–Pumpido Garcia, # <u>2</u> Exhibit 2 – EOS – customs, # <u>3</u> Exhibit 3 – Centrafarm v. Sterling Drug 15–74) (Bellamy, Glenn) (Entered: 03/03/2014) |
| 03/04/2014 | <u>602</u> | NOTICE: Please be aware that a Telephone Conference is set for 3/27/2014 at 09:30 AM by teleconference before Judge Michael R. Barrett; YOU MUST ACCESS THIS DOCUMENT TO OBTAIN CONFERENCING INFORMATION. PLEASE BE AWARE THAT YOU MUST BE LOGGED INTO CM/ECF THROUGH THE COURTS WEBSITE (NOT PACER) AT WWW.OHSD.USCOURTS.GOV USING YOUR OWN PASSWORD BEFORE RETRIEVING THIS DOCUMENT THROUGH THE NOTICE OF ELECTRONIC FILING. (ba1) (Entered: 03/04/2014)   |
| 03/04/2014 | <u>603</u> | ORDER granting <u>600</u> Motion for Leave to Appear Pro Hac Vice of Andre A. Gibson for Defendant Core Servicios Informaticos S.I.. Signed by Judge Michael R. Barrett on 3/4/14. (ba1) (Entered: 03/04/2014)   |
| 03/06/2014 | <u>604</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE at to Hock Group LLC d/b/a ProfessorInk.com. Signed by Judge Michael R. Barrett on 3/6/14. (ba1) (Entered: 03/06/2014)   |
| 03/06/2014 | <u>605</u> | STIPULATED PERMANENT INJUNCTION AS TO Hock Group LLC. Signed by Judge Michael R. Barrett on 3/6/14. (ba1) (Entered: 03/06/2014)  |
| 03/10/2014 | <u>606</u> | Consent MOTION for Extension of Time to File Response/Reply as to <u>582</u> MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies <i>And Memorandum in Support</i> New date requested 3/31/2014. by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 03/10/2014)  |
| 03/17/2014 | <u>607</u> | RESPONSE in Opposition re <u>566</u> MOTION to Dismiss for Lack of Jurisdiction filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Declaration of Audra C. Eidem Heinze (Ex A filed under seal), # <u>2</u> Declaration of Andrew  |

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|            |            | Gardner, # <u>3</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 03/17/2014)  |
| 03/17/2014 | <u>608</u> | RESPONSE in Opposition re <u>601</u> MOTION to Dismiss <i>For Lack Of Subject Matter Jurisdiction, For Lack Of Personal Jurisdiction, Improper Venue, For Failure To State A Claim, Or In The Alternative A Motion For Summary Judgment And Incorporated Memorandum Of Law</i> filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Declaration of Audra C. Eidem Heinze (Ex A filed under seal), # <u>2</u> Declaration of Andrew Gardner, # <u>3</u> Declaration of Ron Hanson, # <u>4</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 03/17/2014) |
| 03/17/2014 | <u>609</u> | RESPONSE in Opposition re <u>591</u> MOTION to Dismiss <i>For Lack Of Subject Matter Jurisdiction, For Lack Of Personal Jurisdiction, Improper Venue, For Failure To State A Claim, Or In The Alternative A Motion For Summary Judgment And Incorporated Memorandum Of Law</i> filed by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Declaration of Audra C. Eidem Heinze (Ex A filed under seal), # <u>2</u> Declaration of Andrew Gardner, # <u>3</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 03/17/2014)                                       |
| 03/18/2014 | <u>610</u> | ORDER granting <u>606</u> Motion for Extension of Time to File Response/Reply re <u>582</u> MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies <i>And Memorandum in Support</i> ; Responses due by 3/31/2014. Signed by Judge Michael R. Barrett on 3/18/14. (ba1) (Entered: 03/18/2014)   |
| 03/27/2014 | <u>614</u> | ORDER granting <u>440</u> Motion for Leave to File Surreply re <u>395</u> Motion to Dismiss. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)  |
| 03/27/2014 | <u>615</u> | ORDER granting <u>395</u> Motion to Dismiss for Failure to State a Claim as to Defendant Impression Products, Inc. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)  |
| 03/27/2014 | <u>616</u> | ORDER denying <u>378</u> Motion for Leave to File to file surrepy. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)  |
| 03/27/2014 | <u>617</u> | ORDER denying <u>335</u> Motion to Dismiss for Failure to State a Claim as to Defendant Impression Products, Inc. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)   |
| 03/27/2014 | <u>618</u> | ORDER finding as moot <u>571</u> Motion for Default Judgment; granting <u>596</u> Motion to set aside entry of default as to Core Servicios; <u>570</u> Clerk's entry of default is withdrawn; Core Servicios shall answer <u>463</u> Section Amended Complaint on or before 3/3/14; Plaintiff shall file it opposition to Core Servicios' <u>601</u> Motion to Dismiss on or before 3/17/14; Core Servicios shall file its reply on or before 3/31/14. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)   |
| 03/27/2014 | <u>619</u> | STIPULATED PERMANENT INJUNCTION and Dismissal with Prejudice with respect to OnlineTechStores.com, Inc. filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)  |
| 03/27/2014 | <u>620</u> | STIPULATED PERMANENT INJUNCTION AND DISMISSAL WITH PREJUDICE with respect to Recyca BVBA filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)   |
| 03/27/2014 | <u>621</u> | DISMISSAL WITH PREJUDICE re <u>620</u> Permanent Injunction as to Recyca BVBA granting <u>594</u> Motion for entry of consent judgment and dismissal with prejudice. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)  |
| 03/27/2014 | <u>622</u> | ORDER finding as moot <u>259</u> Motion to Dismiss for Failure to State a Claim; finding as moot <u>259</u> Motion to Dismiss for Lack of Jurisdiction; finding as moot <u>259</u> Motion to Change Venue. Signed by Judge Michael R. Barrett on 3/26/14. (ba1) (Entered: 03/27/2014)  |
| 03/27/2014 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 3/27/2014; Tim Meece and Jason Shull appeared for Plaintiff; Glenn Bellamy and Andre Gibson appeared for Defendant Core Servicios; Edward   |



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|            |            | O'Connor appeared for Defendant Impression Products; Will Hutchins appeared for Defendant LD Products; David Kern appeared for Interseroh Products; motions hearing set 4/29/14 at 1:00 pm before the Honorable Michael R. Barrett, Courtroom 109 re <u>591</u> MOTION to Dismiss, <u>566</u> MOTION to Dismiss and <u>601</u> Motion to Dismiss (ba1) (Entered: 03/27/2014)   |
| 03/28/2014 | <u>623</u> | NOTICE of Appearance by Gregory Frederick Ahrens for Defendant John Does (Ahrens, Gregory) (Entered: 03/28/2014)   |
| 03/28/2014 | <u>624</u> | Unopposed MOTION for Extension of Time to File Response/Reply as to <u>582</u> MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies And <i>Memorandum in Support</i> New date requested 4/14/2014. by Defendant John Does. (Ahrens, Gregory) (Entered: 03/28/2014)   |
| 03/28/2014 | <u>625</u> | Corporate Disclosure Statement by Defendant John Does. (Ahrens, Gregory) (Entered: 03/28/2014)   |
| 03/31/2014 | <u>626</u> | MOTION for Entry of Stipulated Permanent Injunction and Dismissal with Prejudice as to NLGlobal Corp. by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex 1 – Stipulated Permanent Injunction and Dismissal with Prejudice as to NLGlobal) (Shull, Jason) (Entered: 03/31/2014)  |
| 03/31/2014 | <u>627</u> | MOTION for Entry of Stipulated Permanent Injunction and Dismissal with Prejudice as to OW Supplies by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex 1 – Stipulated Permanent Injunction and Dismissal with Prejudice as to OW Supplies) (Shull, Jason) (Entered: 03/31/2014)  |
| 03/31/2014 | <u>628</u> | MOTION to Strike <u>609</u> Response in Opposition to Motion,, <i>Exhibit A</i> by Defendant Core Servicios Informaticos S.I.. Responses due by 4/21/2014 (Bellamy, Glenn) (Entered: 03/31/2014)   |
| 03/31/2014 | <u>629</u> | MOTION to Strike <u>608</u> Response in Opposition to Motion,, <i>Exhibit A</i> by Defendant Eco Service Sp. z o.o.. Responses due by 4/21/2014 (Bellamy, Glenn) (Entered: 03/31/2014)   |
| 03/31/2014 | <u>630</u> | REPLY to Response to Motion re <u>591</u> MOTION to Dismiss <i>For Lack Of Subject Matter Jurisdiction, For Lack Of Personal Jurisdiction, Improper Venue, For Failure To State A Claim, Or In The Alternative A Motion For Summary Judgment And Incorporated Memorandum Of Law</i> filed by Defendant Eco Service Sp. z o.o.. (Attachments: # <u>1</u> Exhibit Exhibit 1) (Bellamy, Glenn) (Entered: 03/31/2014)  |
| 03/31/2014 | <u>631</u> | REPLY to Response to Motion re <u>601</u> MOTION to Dismiss <i>For Lack Of Subject Matter Jurisdiction, For Lack Of Personal Jurisdiction, Improper Venue, For Failure To State A Claim, Or In The Alternative A Motion For Summary Judgment And Incorporated Memorandum Of Law</i> filed by Defendant Core Servicios Informaticos S.I.. (Attachments: # <u>1</u> Exhibit Exhibit A) (Bellamy, Glenn) (Entered: 03/31/2014)  |
| 03/31/2014 | <u>632</u> | Amended Reply to Response to Motion re <u>630</u> Reply to Response to Motion, <i>To Dismiss For Lack Of Subject Matter Jurisdiction, For Lack of Personal Jurisdiction, Improper Venue, For Failure To State A Claim, Or In The Alternative A Motion For Summary Judgment And Incorporated Memorandum Of Law</i> by Defendant Eco Service Sp. z o.o.. (Attachments: # <u>1</u> Exhibit 1 – Declaration of Mr. Adamski) (Bellamy, Glenn) Modified docket text on 4/1/2014 (eh1). (Entered: 03/31/2014) |
| 03/31/2014 | <u>633</u> | Unopposed MOTION for Extension of Time to File Response/Reply New date requested 4/7/2014. by Defendant Interseroh Product Cycle GmbH. (Kern, David) (Entered: 03/31/2014)   |
| 04/02/2014 |            | NOTICE of Hearing on Motions re <u>591</u> MOTION to Dismiss, <u>566</u> MOTION to Dismiss and <u>601</u> MOTION to Dismiss; Please be aware the motion hearing set for 4/29/14 is RESET from 4/29/14 to 4/30/2014 and remains set at 01:00 PM in Courtroom 109 – Cincinnati before Judge Michael R. Barrett. (ba1) (Entered: 04/02/2014)  |

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| 04/03/2014 | <u>634</u> | ORDER granting <u>633</u> Motion for Extension of Time to File Response/Reply re <u>566</u> MOTION to Dismiss for Lack of Jurisdiction ; Replies due by 4/7/2014. Signed by Judge Michael R. Barrett on 4/3/14. (ba1) (Entered: 04/03/2014)  |
| 04/03/2014 | <u>635</u> | STIPULATED PERMANENT INJUNCTION AND DISMISSAL WITH PREJUDICE as to OW Supplies. Signed by Judge Michael R. Barrett on 4/3/14. (ba1) (Entered: 04/03/2014)  |
| 04/03/2014 | <u>636</u> | STIPULATED PERMANENT INJUNCTION AND DISMISSAL WITH PREJUDICE as to NLGlobal Corp. Signed by Judge Michael R. Barrett on 4/3/14. (ba1) (Entered: 04/03/2014)  |
| 04/03/2014 | <u>637</u> | ORDER granting <u>624</u> Motion for Extension of Time to File Response/Reply re <u>582</u> MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies <i>And Memorandum in Support</i> ; Responses due by 4/14/2014. Signed by Judge Michael R. Barrett on 4/3/14. (ba1) (Entered: 04/03/2014)  |
| 04/07/2014 | <u>638</u> | REPLY to Response to Motion re <u>566</u> MOTION to Dismiss for Lack of Jurisdiction filed by Defendant Interseroh Product Cycle GmbH. (Kern, David) (Entered: 04/07/2014)   |
| 04/10/2014 | <u>639</u> | MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal with Prejudice as to Sinotime Technologies by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex 1 – Stipulated Injunction and Judgment and Dismissal – Sinotime Technologies) (Shull, Jason) (Entered: 04/10/2014)  |
| 04/10/2014 | <u>640</u> | MOTION for Leave to Appear Pro Hac Vice of William E. Thomson (Filing fee \$ 200, receipt number 0648–4520830) by Defendant Benigno Adeva And His Companies. (Attachments: # <u>1</u> Exhibit Certificate of Good Standing) (Ahrens, Gregory) (Entered: 04/10/2014)  |
| 04/14/2014 | <u>641</u> | MOTION for Entry of Stipulated Permanent Injunction, Final Judgment and Dismissal with Prejudice as to Tech Optics, Inc. by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex 1 – Stipulated Injunction and Judgment and Dismissal – Tech Optics) (Shull, Jason) (Entered: 04/14/2014)  |
| 04/14/2014 | <u>642</u> | RESPONSE in Opposition re <u>582</u> MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies <i>And Memorandum in Support</i> filed by Defendant Benigno Adeva And His Companies. (Attachments: # <u>1</u> Exhibit 1, # <u>2</u> Exhibit 2, # <u>3</u> Exhibit 3, # <u>4</u> Exhibit 4, # <u>5</u> Exhibit 5) (Ahrens, Gregory) (Entered: 04/14/2014) |
| 04/15/2014 | <u>643</u> | ORDER granting <u>640</u> Motion for Leave to Appear Pro Hac Vice of William Thomson for Defendants Tonerboss, LLC, All Color Imaging, ABD Office Machines, Inc., ACI Supplies, LLC, and Mr. Benigno Adeva. Signed by Judge Michael R. Barrett on 4/11/14. (ba1) (Entered: 04/15/2014)   |
| 04/17/2014 | <u>644</u> | MOTION for Entry of Stipulated Permanent Injunction and Dismissal with Prejudice as to LD Products, Inc by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex 1 – Stipulated Permanent Injunction and Dismissal with Prejudice as to LD Products) (Shull, Jason) (Entered: 04/17/2014)   |
| 04/24/2014 | <u>645</u> | RESPONSE in Opposition re <u>628</u> MOTION to Strike <u>609</u> Response in Opposition to Motion,, <i>Exhibit A</i> filed by Plaintiff Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 04/24/2014)   |
| 04/24/2014 | <u>646</u> | RESPONSE in Opposition re <u>629</u> MOTION to Strike <u>608</u> Response in Opposition to Motion,, <i>Exhibit A</i> filed by Plaintiff Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 04/24/2014)   |
| 04/29/2014 | <u>647</u> | STIPULATED PERMANENT INJUNCTION Dismissal with Prejudice as to LD Products, Inc filed by Lexmark International, Inc. Signed by Judge Michael R. Barrett on 4/28/14. (ba1) (Entered: 04/29/2014)  |
| 04/29/2014 | <u>648</u> | STIPULATED PERMANENT INJUNCTION as to Sinotime Technologies, Inc. Signed by Judge Michael R. Barrett on 4/28/14. (ba1) (Entered: 04/29/2014)   |

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| 04/29/2014 | <u>649</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE as to Sinotime Technologies, Inc. Signed by Judge Michael R. Barrett on 4/28/14. (ba1) (Entered: 04/29/2014)  |
| 04/29/2014 | <u>650</u> | STIPULATED PERMANENT INJUNCTION as to Tech Optics, Inc. Signed by Judge Michael R. Barrett on 4/28/14. (ba1) (Entered: 04/29/2014)  |
| 04/29/2014 | <u>651</u> | FINAL JUDGMENT AND DISMISSAL WITH PREJUDICE as to Tech Optics, Inc. Signed by Judge Michael R. Barrett on 4/28/14. (ba1) (Entered: 04/29/2014)  |
| 04/30/2014 | <u>652</u> | Minute Entry for proceedings held before Judge Michael R. Barrett: Motion Hearing held on 4/30/2014 re <u>566</u> MOTION to Dismiss, <u>591</u> MOTION to Dismiss, and <u>601</u> MOTION to Dismiss. Jason Shull and Audra Heinze appeared for Plaintiff; David Kern appeared for Defendant Interseroh Product Cycle; Glenn Bellamy and Andre Gibson appeared for Defendants Core Servicios Informaticos S.I and Eco Service Sp. z o.o. Discovery issues discussed; arguments on motions heard; motions taken under advisement; order to follow. (eh) (Entered: 04/30/2014) |
| 04/30/2014 | <u>653</u> | Unopposed MOTION for Extension of Time to File Response/Reply as to <u>582</u> MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies <i>And Memorandum in Support</i> New date requested 5/9/2014. by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 04/30/2014)  |
| 05/02/2014 | <u>654</u> | ORDER granting <u>653</u> Motion for Extension of Time to File Reply re <u>582</u> MOTION To Institute Contempt Proceedings. Lexmark shall have until May 9, 2014, to file its reply in support of the Motion. Signed by Judge Michael R. Barrett on 5/2/14. (eh) (Entered: 05/02/2014)   |
| 05/09/2014 | <u>655</u> | Unopposed MOTION for Extension of Time to File Response/Reply as to <u>582</u> MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies <i>And Memorandum in Support</i> New date requested 5/23/2014. by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Text of Proposed Order) (Eidem Heinze, Audra) (Entered: 05/09/2014)   |
| 05/14/2014 | <u>656</u> | ORDER granting <u>655</u> Motion for Extension of Time to File Response/Reply re <u>582</u> MOTION To Institute Contempt Proceedings To Determine Violation Of Permanent Injunction Order By Benigno Adeva And His Companies <i>And Memorandum in Support</i> ; Replies due by 5/23/2014. Signed by Judge Michael R. Barrett on 5/14/14. (ba1) (Entered: 05/14/2014)  |
| 05/23/2014 | <u>657</u> | Joint MOTION For Entry Of Stipulated Permanent Injunction And Stipulated Order For Contempt As To The Adeva Entities by Plaintiff Lexmark International, Inc.. (Attachments: # <u>1</u> Ex 1 – Stipulated Permanent Injunction, # <u>2</u> Ex 2 – Stipulated Order for Contempt) (Shull, Jason) (Entered: 05/23/2014)   |
| 05/23/2014 |            | NOTICE of Hearing on Motion re <u>578</u> MOTION for Default Judgment against Direct Billing and Memorandum in Support and <u>598</u> MOTION for Default Judgment against Zhuhai Aicon Image Co. Ltd. and Memorandum in Support; Please be aware that a Motion Hearing is set for 6/23/2014 at 02:00 PM in Courtroom 109 – Cincinnati before Judge Michael R. Barrett; Plaintiff's Counsel is responsible for notifying the Defendant of the date and time of this setting. (ba1) (Entered: 05/23/2014)   |
| 05/29/2014 | <u>658</u> | NOTICE of Voluntary Dismissal as to Defendant Eco Service Sp. Z o.o. by Plaintiff Lexmark International, Inc. (Eidem Heinze, Audra) Modified to include defendant on 5/30/2014 (eh1). (Entered: 05/29/2014)   |
| 05/29/2014 | <u>659</u> | NOTICE of Voluntary Dismissal as to Defendant Core Servicios Informaticos, S.L. by Plaintiff Lexmark International, Inc. (Eidem Heinze, Audra) Modified to include defendant on 5/30/2014 (eh1). (Entered: 05/29/2014)  |
| 05/29/2014 | <u>660</u> | NOTICE of Voluntary Dismissal as to Defendant Interseroh Product Cycle GmbH by Plaintiff Lexmark International, Inc. (Eidem Heinze, Audra) Modified to include defendant on 5/30/2014 (eh1). (Entered: 05/29/2014)  |

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| 06/03/2014 |            | NOTICE of Hearing: Please be aware that a Status Conference is set for 6/9/2014 at 04:45 PM by teleconference before Judge Michael R. Barrett; parties shall initiate contact with the Court by calling 513-564-7660 five minutes prior to 4:45 pm (ba1) (Entered: 06/03/2014)   |
| 06/09/2014 |            | Minute Entry for proceedings held before Judge Michael R. Barrett: Status Conference held on 6/9/2014; Timothy Meece appeared for Plaintiff; David Kern appeared for Defendant Quality Cartridges; Glenn Bellamy and Andre Gibson appeared for Core Servicios Informaticos S.I. and Eco Service Sp. z o.o.; Edward O'Connor appeared for Impression Products; matter reported resolved; parties to provide entry. (ba1) Modified to correct party names on 6/10/2014 (jee). (Entered: 06/10/2014)  |
| 06/17/2014 | <u>662</u> | STIPULATED PERMANENT INJUNCTION as to Benigno (Benny) Adeva; ACI Supplies, LLC; All Color Imaging, Inc.; ABD Office Machines, Inc. d/b/a ABD Office Machines, Inc., ABD Office Solutions, InkTonerDepot.com, ABD Office Solutions; and TonerBoss LLC d/b/a TonerOfEarth, TonerGreen, JustGreenStuff.com, Inkjet Universe, RoboToner, ColorToner Expert, TonerFarm. Signed by Judge Michael R. Barrett on 6/17/14. (ba1) (Entered: 06/17/2014)  |
| 06/17/2014 | <u>663</u> | STIPULATED ORDER FOR CONTEMPT as to Benigno (Benny) Adeva; ACI Supplies, LLC; All Color Imaging, Inc.; ABD Office Machines, Inc. d/b/a ABD Office Machines, Inc., ABD Office Solutions, InkTonerDepot.com, ABD Office Solutions; and TonerBoss LLC d/b/a TonerOfEarth, TonerGreen, JustGreenStuff.com, Inkjet Universe, RoboToner, ColorToner Expert, TonerFarm. Signed by Judge Michael R. Barrett on 6/17/14. (ba1) (Entered: 06/17/2014)  |
| 06/17/2014 | <u>664</u> | ORDER finding as moot <u>582</u> Motion to Institute Contempt Proceedings. Signed by Judge Michael R. Barrett on 6/17/14. (ba1) (Entered: 06/17/2014)  |
| 06/23/2014 | <u>665</u> | Minute Entry for proceedings held before Judge Michael R. Barrett: Motion Hearing held on 6/23/2014 re <u>578</u> MOTION for Default Judgment against Direct Billing and Memorandum in Support filed by Lexmark International, Inc. and <u>598</u> MOTION for Default Judgment against Zhuhai Aicon Image Co. Ltd. and Memorandum in Support filed by Lexmark International, Inc; Counsel for plaintiff appeared; no appearance by defendants; motions to be granted; order to follow (Court Reporter Maryann Maffia, Official.) (ba1) (Entered: 06/23/2014) |
| 06/23/2014 | <u>666</u> | ORDER granting <u>578</u> Motion for Default Judgment against Direct Billing International Incorporated d/b/a Office Supply Outfitters. Signed by Judge Michael R. Barrett on 6/23/14. (ba1) (Entered: 06/23/2014)   |
| 06/23/2014 | <u>667</u> | ORDER granting <u>598</u> Motion for Default Judgment against Zhuhai Aicon Image Co. Ltd. Signed by Judge Michael R. Barrett on 6/23/14. (ba1) (Entered: 06/23/2014)   |
| 06/24/2014 | <u>668</u> | STIPULATED PERMANENT INJUNCTION as to Impression Products, Inc. Signed by Judge Michael R. Barrett on 6/23/14. (ba1) (Entered: 06/24/2014)   |
| 06/24/2014 | <u>669</u> | ORDER granting 661 SEALED MOTION filed by Impression Products, Inc., Lexmark International, Inc. Signed by Judge Michael R. Barrett on 6/23/14. (ba1) (Entered: 06/24/2014)  |
| 06/24/2014 | <u>670</u> | STIPULATED FINAL JUDGMENT. Signed by Judge Michael R. Barrett on 6/23/14. (ba1) (Entered: 06/24/2014)  |
| 06/26/2014 | <u>671</u> | NOTICE OF APPEAL as to <u>670</u> Judgment by Defendant Impression Products, Inc.. Filing fee \$ 505, receipt number 0648-4628231. (Attachments: # <u>1</u> Exhibit A) (O'Connor, Edward) (Entered: 06/26/2014)  |
| 06/27/2014 | <u>672</u> | NOTICE OF APPEAL as to <u>670</u> Judgment by Plaintiff Lexmark International, Inc.. Filing fee \$ 505, receipt number 0648-4630567. (Eidem Heinze, Audra) (Entered: 06/27/2014)   |
| 07/14/2014 |            | USCA Federal Circuit Case Number 14-1617 for <u>671</u> Notice of Appeal filed by Impression Products, Inc. (sct1) (Entered: 07/14/2014)   |



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| 07/14/2014 |            | USCA for the Federal Circuit Case Number 14-1619 for <u>672</u> Notice of Appeal filed by Lexmark International, Inc. (sct1) (Entered: 07/14/2014)   |
| 07/15/2014 | <u>673</u> | TRANSCRIPT REQUEST <i>as to Lexmark International, Inc. pursuant to Rules 10(b) and 11(b) of the Federal Rules of Appellate Procedure.</i> by Plaintiff Lexmark International, Inc.. (Eidem Heinze, Audra) (Entered: 07/15/2014)   |
| 07/18/2014 | <u>674</u> | ORDER granting <u>576</u> MOTION to Withdraw <u>425</u> Motion for Contempt against Direct Billing for Violation of This Court's Permanent Injunction Order MOTION for Default Judgment against Direct Billing by Plaintiff Lexmark International, Inc. Signed by Judge Michael R. Barrett on 7/18/14. (eh1) (Entered: 07/18/2014)   |
| 08/05/2014 | <u>675</u> | STIPULATION <i>Satisfaction of Judgment as to NGS, S.A.</i> by Plaintiff Lexmark International, Inc.. (Shull, Jason) (Entered: 08/05/2014)   |
| 09/04/2014 | <u>676</u> | STIPULATION <i>Satisfaction of Judgment as to Refilterner</i> by Plaintiff Lexmark International, Inc.. (Shull, Jason) (Entered: 09/04/2014)   |
| 09/18/2014 |            | NOTICE OF HEARING: Please be aware that a hearing on the Motion for Contempt against Direct Billing and Michael Gardner for Violation of this Court's Permanent Injunction Order (Doc. 577) is set for September 24, 2014 at 1:00 pm by teleconference before Judge Michael R. Barrett; the parties participating in the hearing shall initiate contact with the Court by calling 513-564-7660 five (5) minutes prior to 1:00 pm; counsel for Lexmark shall be responsible for notifying Direct Billing and Michael Gardner of the time, date and instructions for participating in the hearing. (eh1) (Entered: 09/18/2014)   |
| 09/18/2014 |            | Set Deadlines: Motion Hearing as to <u>577</u> Motion for Contempt <i>against Direct Billing and Michael Gardner</i> set for 9/24/2014 at 01:00 PM in Teleconference before Judge Michael R. Barrett. (eh1) (Entered: 09/18/2014)  |
| 09/24/2014 |            | Minute entry for proceedings held before Judge Michael R. Barrett: Motion hearing held on 9/24/2014 re motion for contempt against Direct Billing and Michael Gardner Document <u>577</u> ; Jason Shull appeared on behalf of Plaintiff; Michael Gardner appeared on his own behalf; the hearing is continued in progress until October 8, 2014 at 5:30 pm Eastern time at which time the hearing shall be conducted by teleconference before Judge Michael R. Barrett; the parties are reminded that they shall initiate the teleconference by calling chambers at 513-564-7660 five minutes prior to the scheduled time. (Court Reporter Luke Lavin, Official) (eh1) (Entered: 09/24/2014) |
| 10/09/2014 | <u>677</u> | ORDER granting <u>577</u> Motion for Contempt as to Direct Billing's Owner and President. Signed by Judge Michael R. Barrett on 10/9/14. (ba1) (Entered: 10/09/2014)   |
| 10/09/2014 | <u>678</u> | ORDER granting <u>577</u> Motion for Contempt against Direct Billing. Signed by Judge Michael R. Barrett on 10/9/14. (ba1) (Entered: 10/09/2014)   |

UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION

FILED  
JAMES BONINI  
CLERK

10 AUG 20 PM 2: 25

U.S. DISTRICT COURT  
SOUTHERN DIST. OHIO  
WEST DIV. CINCINNATI

LEXMARK INTERNATIONAL, INC.

Plaintiff,

v.

INK TECHNOLOGIES PRINTER SUPPLIES, LLC d/b/a INK TECHNOLOGIES LLC, NINESTAR IMAGE CO. LTD, a/k/a NINESTAR TECHNOLOGY CO., LTD., NINESTAR IMAGE INT'L, LTD., SEINE IMAGE INTERNATIONAL CO. LTD., NINESTAR TECHNOLOGY COMPANY, LTD., ZIPPRINT IMAGE CORPORATION, NANO PACIFIC CORPORATION, IJSS INC., d/b/a TONERZONE.COM INC., and d/b/a INKJET SUPERSTORE, CHUNG PAL SHIN d/b/a INK MASTER, NECTRON INTERNATIONAL, INC., QUALITY CARTRIDGES INC., DIRECT BILLING INTERNATIONAL INCORPORATED, d/b/a OFFICE SUPPLY OUTFITTERS and d/b/a THE RIBBON CONNECTION, E-TONER MART, INC., ALPHA IMAGE TECH, ACM TECHNOLOGIES, INC., VIRTUAL IMAGING PRODUCTS INC., ACECOM INC. – SAN ANTONIO d/b/a INKSELL.COM, JAHWA ELECTRONICS CO., LTD., HUIZHOU JAHWA ELECTRONICS CO., LTD., COPY TECHNOLOGIES INC., LASER TONER TECHNOLOGY, INC., C & R SERVICES, INCORPORATED, d/b/a C & R DISTRIBUTORS and d/b/a C & R DISTRIBUTING, PRINT-RITE HOLDINGS LTD., UNION TECHNOLOGY INT'L (M.C.O.) CO. LTD., and JOHN DOES 1-20,

Defendants.

Civil Action No.

10 CV **1:10CV564**

(Jury Trial Demanded)

**J. BARRETT**

**COMPLAINT FOR PATENT INFRINGEMENT**

Plaintiff Lexmark International, Inc., for its complaint against Defendants Ink Technologies Printer Supplies, LLC d/b/a Ink Technologies LLC, Ninestar Image Co. Ltd. (a/k/a Ninestar Technology Co., Ltd.), Ninestar Image Int'l, Ltd., Seine Image International Co. Ltd., Ninestar Technology Company, Ltd., Zipprint Image Corporation, Nano Pacific Corporation, IJSS Inc., d/b/a TonerZone.com Inc. and d/b/a Inkjet Superstore, Chung Pal Shin d/b/a Ink Master,



Nectron International, Inc., Quality Cartridges Inc., Direct Billing International Incorporated d/b/a Office Supply Outfitters and d/b/a The Ribbon Connection, E-Toner Mart, Inc., Alpha Image Tech, ACM Technologies, Inc., Virtual Imaging Products Inc., Acecom Inc. – San Antonio d/b/a Inksell.com, Jahwa Electronics Co., Ltd., Huizhou Jahwa Electronics Co., Ltd., Copy Technologies Inc., Laser Toner Technology, Inc., C & R Services, Incorporated, Print-Rite Holdings Ltd., Union Technology Int'l (M.C.O.) Co. Ltd., and John Does 1-20 (collectively, “Defendants”) states as follows:

### **NATURE OF CASE**

1. This is an action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. § 1 *et seq.*, and particularly 35 U.S.C. §§ 271 and 281.

2. A parallel complaint for an investigation under Section 337 of the Tariff Act of 1930, 19 U.S.C. § 1337, was filed contemporaneously with the United States International Trade Commission based upon the unlawful importation into the United States, the sale for importation and/or the sale within the United States after importation, of unauthorized, aftermarket toner cartridges, which are complained of herein, for use with Lexmark printers.

### **THE PARTIES**

#### **Plaintiff – Lexmark International, Inc.**

3. Plaintiff Lexmark International, Inc. (“Lexmark”) is a Delaware corporation with its principal place of business in Lexington, KY. Lexmark is a leading worldwide developer, manufacturer, and supplier, of *inter alia*, of laser printers and toner cartridges.

4. Lexmark develops and owns most of the technology for its laser printers and associated supplies. This differentiates Lexmark from a number of its major competitors.

| United States Pat. No.        | Title   | Exhibit |
|-------------------------------|---|---------|
| 5,875,378 (“the ‘378 Patent”) | Toner Cartridge With Hopper Exit Agitator                               | 7       |
| 5,995,772 (“the ‘772 Patent”) | Imaging Apparatus Cartridge Including An Encoded Device                 | 8       |
| 6,009,291 (“the ‘291 Patent”) | Control Of Photosensitive Roller Movement                               | 9       |
| 6,078,771 (“the ‘771 Patent”) | Low Friction Doctor Blade   | 10      |
| 6,397,015 (“the ‘015 Patent”) | Encoded Device Having Positioned Indicia For Use With A Toner Cartridge | 11      |
| 6,459,876 (“the ‘876 Patent”) | Toner Cartridge   | 12      |
| 6,487,383 (“the ‘383 Patent”) | Dynamic End-Seal For Toner Development Unit                             | 13      |
| 6,496,662 (“the ‘662 Patent”) | Optical Toner Low Sensor  | 14      |
| 6,678,489 (“the ‘489 Patent”) | Two Part Cartridges With Force Biasing By Printer                       | 15      |
| 6,816,692 (“the ‘692 Patent”) | Support Assembly For Roller Including Roller Body And Support Shaft     | 16      |
| 6,871,031 (“the ‘031 Patent”) | Coupling Mechanism For A Two Piece Printer Cartridge                    | 17      |
| 6,879,792 (“the ‘792 Patent”) | Two Part Cartridges With Force Biasing By Printer                       | 18      |
| 7,139,510 (“the ‘510 Patent”) | Two Part Cartridges With Force Biasing By Printer                       | 19      |
| 7,233,760 (“the ‘760 Patent”) | Method and Device for Doctor Blade Retention                            | 20      |
| 7,305,204 (“the ‘204 Patent”) | Two Part Cartridges With Force Biasing By Printer                       | 21      |

### **Defendants Generally**

8. On information and belief, Defendants manufacture, remanufacture, import, offer to sell, and/or sell unauthorized aftermarket toner cartridges and developer assemblies that are intended as substitutes for use with one or more of Lexmark’s T520, T610, T620, T630, T640, E120, E220, E230, E232, E234, E238, E240, E250, E320, E322, E321, E323, E330, E332, E340, E342, E350, E352, and/or E450 laser printer series, including clones as well as

remanufactured versions of these cartridges and developer assemblies that originally were first sold outside of the United States (collectively, “the Accused Cartridges”).

9. On information and belief, a number of Defendants are affiliated and/or related to Ninestar Image Co. Ltd., a company known as or formerly known as Ninestar Technology Co., Ltd., (collectively “Ninestar”), a Chinese manufacturer of Accused Cartridges. On information and belief, the table below sets forth those Defendants believed to be affiliated or related to Ninestar Image Co. Ltd., a/k/a Ninestar Technology Co., Ltd.:

| <b>NINESTAR RELATED AND AFFILIATED RESPONDENTS</b>                   |  |
|--|--|
| <b>Manufacturer</b>  | Ninestar Image Co. Ltd.<br>(formerly known as Ninestar Technology Co., Ltd.) (collectively “Ninestar”)<br><br>Ninestar Image Int’l, Ltd.<br><br>Seine Image International Co. Ltd.               |
| <b>Importer</b>  | Ninestar Image Co. Ltd (a/k/a Ninestar Technology Co., Ltd.)<br><br>Ninestar Image Int’l, Ltd.<br><br>Seine Image International Co. Ltd  |
| <b>United States<br/>Subsidiary/Distribution<br/>Center Operator</b> | Ninestar Technology Company, Ltd.<br><br>Nano Pacific Corporation<br><br>Ziprint Image Corporation   |
| <b>Retailers</b>   | Quality Cartridges Inc.<br><br>Acecom Inc. – San Antonio (d/b/a Inksell.com)<br><br>Ink Technologies Printer Supplies, LLC (d/b/a Ink Technologies LLC)<br><br>Chung Pal Shin (d/b/a Ink Master) |

| NINESTAR RELATED AND AFFILIATED RESPONDENTS |   |
|---|---|
|   | IJSS Inc. (d/b/a TonerZone.com, Inc. and/or Inkjet Superstore)<br><br>Direct Billing International Incorporated (d/b/a Office Supply Outfitters and The Ribbon Connection)<br><br>ACM Technologies, Inc.<br><br>Nano Pacific Corporation<br><br>Ziprint Image Corporation |

10. On information and belief, a number of the Defendants are affiliated and/or related to Jahwa Electronics Co., Ltd., a South Korean manufacturer of Accused Cartridges. The table below sets forth those Defendants believed to be affiliated or related to Jahwa Electronics Co., Ltd.:

| JAHWA RELATED AND AFFILIATED RESPONDENTS |  |
|--|--|
| <b>Manufacturer/Importer</b>             | Jahwa Electronics Co., Ltd.<br><br>Huizhou Jahwa Electronics Co., Ltd.                         |
| <b>Distributors</b>                      | Laser Toner Technology, Inc.   |
| <b>Retailers</b>                         | Laser Toner Technology, Inc.<br><br>Copy Technologies Inc.<br><br>C & R Services, Incorporated |

11. On information and belief, a number of Defendants are affiliated and/or related to Print-Rite Holdings Ltd., a Hong Kong based manufacturer of Accused Cartridges. On

information and belief, the table below sets forth those Defendants believed to be affiliated or related to Print-Rite Holdings Ltd.:

| <b>PRINT-RITE RELATED AND AFFILIATED RESPONDENTS</b> |  |
|--|--|
| <b>Manufacturer</b>                                  | Print-Rite Holdings Ltd.   |
| <b>Importer</b>                                      | Union Technology Int'l (M.C.O.) Co. Ltd.   |
| <b>United States Subsidiary</b>                      | N/A  |
| <b>Distributors</b>                                  | Nectron International, Inc.  |
| <b>Retailers</b>                                     | Nectron International, Inc.<br><br>IJSS Inc. (d/b/a TonerZone.com, Inc. and d/b/a Inkjet Superstore) |

12. On information and belief, a number of the Defendants are importing and/or selling Accused Cartridges from unknown foreign manufacturing source(s) including, but not limited to: Alpha Image Tech, E-Toner Mart, Inc. and Virtual Imaging Products Inc.

**Defendant – Ink Technologies Printer Supplies, LLC d/b/a Ink Technologies LLC**

13. On information and belief, Defendant Ink Technologies Printer Supplies, LLC (“Ink Tech”) is a limited liability company registered under the laws of Ohio with a principal place of business located at 7600 McEwen Road, Dayton, OH 45459.

14. On information and belief, Ink Tech conducts business under the name Ink Technologies, LLC.

15. On information and belief, Ink Tech operates a website at <http://www.inktechnologies.com>, which is accessible from this judicial district. According to this website, Ink Tech sells discount Lexmark toner cartridges and is a supplier of printing

UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CASE NO. 1:10-cv-00564-MRB

LEXMARK INTERNATIONAL, INC.  
Plaintiff

v.

INK TECHNOLOGIES PRINTER SUPPLIES, LLC  
*et al*  
Defendants

***STIPULATED PERMANENT INJUNCTION, CONSENT JUDGMENT, AND  
DISMISSAL WITH PREJUDICE***

This matter is before the Court on the stipulated motion of Plaintiff, Lexmark International, Inc. (“Lexmark”) and Defendant Virtual Imaging Products, Inc., **135 Ormont Drive, Unit #14/15, North York, Ontario, M9L 1N6** (“VIP”) for entry of a Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice, as the Parties have agreed to a compromise and settlement of this action.

**IT IS HEREBY FOUND, ORDERED, ADJUDGED WITH CONSENT OF  
THE PARTIES** that:

1. ***VIP, its parent, divisions, subsidiaries affiliates, successors and assigns and its directors, officers, and employees, or any of them*** are, or have been, in the business, among other things, of selling remanufactured and compatible ***toner cartridges in the United States and in foreign countries for use in Lexmark laser printers, including*** E120; E220; E230/232/234/238/240; E320/322; E321/323; and/or E250/350/352/450 laser printers (the “Accused Cartridges”);
2. Lexmark owns and has standing to sue for infringement of United States Patent Nos. ***5,337,032; 5,634,169; 5,758,231; 5,758,233; 5,768,661; 5,802,432; 5,875,378; 5,995,772; 6,009,291; 6,078,771; 6,397,015; 6,459,876;***



6,487,383; 6,496,662; 6,678,489; 6,816,692; 6,871,031; 6,879,792; 7,139,510; 7,233,760; and 7,305,204 (the “Lexmark Patents”);

3. The Lexmark Patents are valid and enforceable against VIP in the United States.

4. Lexmark manufactures and sells toner cartridges for its printer lines, which include T420; T520/522; T610/612/614/616; T620/622; T630/632/634; T640/642/644; E120; E220; E230/232/234/238/240; E320/322; E321/323; and E250/350/352/450 laser printers (“Lexmark Toner Cartridges”).

5. The following table identifies the patent claims of the Lexmark Patents that are satisfied literally by the Lexmark Toner Cartridges:

| Lexmark Toner Cartridges |                               |                         |                       |                                  |                        |                     |
|--------------------------|-------------------------------|-------------------------|-----------------------|----------------------------------|------------------------|---------------------|
| Patent                   | E120                          | E23X/E24X/<br>E33X/E34X | E25X/<br>E35X/E45X    | T52X/T61X/<br>T62X/T63X/T64X     | E320/22                | E220 and<br>E321/23 |
| <b>5,337,032</b>         |                               |                         |                       | 1,5,6                            |                        |                     |
| <b>5,634,169</b>         |                               |                         |                       | 1-3,32-34,<br>36, 42             | 32,36,42               | 32,36,42            |
| <b>5,758,231</b>         |                               | 1-16                    | 1-16                  |                                  | 1-16                   | 1-16                |
| <b>5,758,233</b>         |                               |                         |                       | 1-4                              |                        |                     |
| <b>5,768,661</b>         |                               |                         |                       | 1,2,3,6                          |                        |                     |
| <b>5,802,432</b>         |                               |                         |                       | 1-3, 7-9                         |                        |                     |
| <b>5,875,378</b>         |                               |                         |                       | 1-3,12-14,24                     |                        |                     |
| <b>5,995,772</b>         |                               |                         |                       | 1-3,5,7-9,<br>12,14-18,20,21     | 14,15,22<br>,<br>32-34 | 14,15,22,<br>32-34  |
| <b>6,009,291</b>         | 1-2                           | 1-2                     | 1-2                   | 1-2                              |                        |                     |
| <b>6,078,771</b>         | 1,5,6,10<br>,<br>12,13,1<br>5 | 1,5,6,10,<br>12,13,15   | 1,5,6,10,<br>12,13,15 | 1,2,5,6,10,<br>12,13,15          |                        |                     |
| <b>6,397,015</b>         |                               |                         |                       | 1-4,7-12,<br>14-19,22-24<br>1-28 | 1,2,4,<br>9,17,19      | 1,2,4,<br>9,17,19   |
| <b>6,459,876</b>         |                               |                         |                       |                                  |                        |                     |
| <b>6,487,383</b>         | 1,2,6,<br>10,15,1<br>9        | 1,2,6,<br>10,15,19      | 1,2,6,<br>10,15,19    | 1,2,6,10,<br>11,15,19            | 19                     | 19                  |
| <b>6,496,662</b>         |                               | 1,3,5,7                 | 1,3,5,7               |                                  |                        |                     |
| <b>6,678,489</b>         |                               | 5-6                     | 5-6                   |                                  |                        |                     |
| <b>6,816,692</b>         | 1-13                          | 1-13                    | 1-13                  |                                  |                        |                     |
| <b>6,871,031</b>         |                               | 1-6,8-12                | 1-6,8-12              |                                  |                        |                     |
| <b>6,879,792</b>         |                               | 1-11                    | 1-11                  |                                  |                        |                     |
| <b>7,139,510</b>         |                               | 1-10                    | 1-10                  |                                  |                        |                     |
| <b>7,233,760</b>         | 11,12,1<br>4                  | 11,12,14                | 11,12,14              |                                  |                        |                     |
| <b>7,305,204</b>         |                               | 1-20                    | 1-8,10-13             |                                  |                        |                     |

6. The use, remanufacture, offer to sell or sale in the United States by anyone other than Lexmark or a licensee of Lexmark of any remanufactured Lexmark Toner Cartridges that were originally sold outside the United States constitutes an infringement of some or all of the above-identified claims in the Lexmark Patents, except to the extent that Lexmark has exhausted its rights in such patents.

7. Lexmark alleges that VIP's importation into and sale in the United States of compatible and/or remanufactured or refilled E120; E220/E321/E323; E230/232/234/238/240 and E250/350/352/450 toner cartridges first sold outside of the United States infringe at least the claims of the patents set forth in the table below, except to the extent that Lexmark has exhausted its rights in such patents:

| Patents-in-Suit  | VIP Toner Cartridges               |                                 |  |  |
|------------------|------------------------------------|---------------------------------|--|--|
|                  | <i>E120</i>                        | <i>E23x/E24x/<br/>E33x/E34x</i> | <i>E25x/E35x/E45x</i>  | <i>E220 and<br/>E321/E323<br/>32, 36, 42</i> |
| <i>5,634,169</i> |                                    |                                 |  |  |
| <i>5,758,231</i> |                                    | <i>1-16</i>                     | <i>1-16</i>  | <i>1-16</i>                                  |
| <i>5,995,772</i> |                                    |                                 |  | <i>14, 15, 22, 32</i>                        |
| <i>6,078,771</i> | <i>1, 5, 6, 10,<br/>12, 13, 15</i> |                                 |  |  |
| <i>6,397,015</i> |                                    |                                 |  | <i>1, 2, 4, 9, 17, 19</i>                    |
| <i>6,496,662</i> |                                    | <i>1, 3, 5, 7</i>               | <i>1, 3, 5, 7<br/>5, 6<br/>1<br/>1-6, 8-12<br/>1-11<br/>1-10</i> |  |
| <i>6,678,489</i> |                                    | <i>5, 6</i>                     |  |  |
| <i>6,816,692</i> | <i>1-3, 5, 7, 8,<br/>10, 13</i>    | <i>1</i>                        |  |  |
| <i>6,871,031</i> |                                    | <i>1-6, 8-12</i>                |  |  |
| <i>6,879,792</i> |                                    | <i>1-11</i>                     |  |  |
| <i>7,139,510</i> |                                    | <i>1-10</i>                     |  |  |
| <i>7,233,760</i> | <i>11, 12, 14</i>                  |                                 |  |  |
| <i>7,305,204</i> |                                    | <i>1-8, 10-13</i>               | <i>1-8, 10-13</i>  |  |

8. *VIP is entering into this Stipulated Permanent Injunction, Consent Judgment and Dismissal With Prejudice solely for the purpose of resolving the present litigation; and nothing herein shall be construed as an admission by VIP that it infringed or otherwise violated any of Lexmark's rights in the Lexmark Patents or as a decision by this Court that VIP has infringed or otherwise violated any of Lexmark's rights in the Lexmark Patents.*

9. This Court permanently enjoins VIP and those persons or companies in active concert or participation with VIP who receive actual notice of the order by personal service or otherwise from making, using, selling, offering for sale in or

importing into the United States Accused Cartridges that infringe any of the above-identified patent claims.

10. Nothing herein limits or shall be construed to limit in any way VIP's activities with respect to toner cartridges in which Lexmark's patent *rights* have been exhausted. ***Further, nothing herein limits or shall be construed to limit in any way VIP's activities with respect to any Lexmark Patents that have expired, lapsed, are no longer enforceable, or have found to be invalid by a court of competent jurisdiction. Finally, nothing herein limits or*** shall be construed to limit in any way VIP's activities outside the United States.

11. Contingent upon this Court's entry of this Order, VIP consents to personal jurisdiction by this Court, consents to venue in this District, and waives services of process for this action.

12. This Court retains jurisdiction over Lexmark and VIP to the extent necessary to enforce the terms of this Stipulated Permanent Injunction, Consent Judgment, and Dismissal With Prejudice.

13. This Stipulated Permanent Injunction, Consent Judgment, and Dismissal With Prejudice shall be binding upon and shall inure to the benefit of Lexmark and VIP as well as each of their respective subsidiaries, corporate parents, affiliates, and/or successors and assigns.

14. All claims between Lexmark and VIP are hereby dismissed with prejudice, with each party to bear its own costs and attorneys' fees.

### **IT IS SO ORDERED**

s/Michael R. Barrett  
The Honorable Michael R. Barrett  
United States District Court Judge

HAVE SEEN AND AGREED TO ON NOVEMBER 30, 2010;  
TO BE ENTERED:

By: /s/Steven B. Loy

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# Lexmark E220, E320/E322, and E321/E322 Cartridges

U.S. Pat. No. 5,634,169

Lexmark E220, E320/E322, and E321/E323 Cartridges

1

A0696

Exhibit 20 to Reinholz Declaration

# Asserted Claims Applicable to Lexmark E220, E320/E322, and E321/E323 Cartridges

- Asserted Claims in Pat. No.  
5,634,169:
    - 32, 36, 42
  - Claim Dependencies:
    - Claim 32
    - Claim 36
- +-----42

Lexmark E220, E320/E322, and E321/E323 Cartridges

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## Claim 32 - Pat. No. 5,634,169

|  |     |
|--|-----|
| 32. A cartridge for an electrophotographic machine, comprising:  | Yes |
| a sump for carrying a quantity of toner;   | Yes |
| a toner agitator mounted in said sump; and   | Yes |
| a single encoded wheel rotating in relation to said toner agitator, said encoded wheel including coding for determining a quantity of toner in said cartridge. | Yes |

Lexmark E220, E320/E322, and E321/E323 Cartridges

3

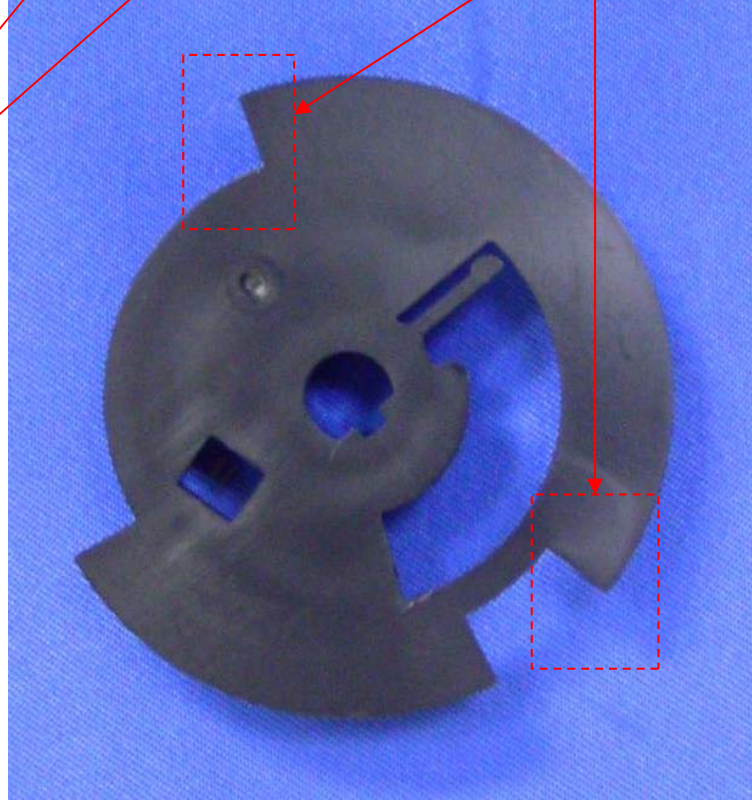
A0698

Exhibit 20 to Reinholz Declaration

## Claim 32 - Pat. No. 5,634,169 (cont'd)

See E220, E320/E322, and  
E321/E323 Cartridges

32. A cartridge for an electrophotographic machine, comprising:  
a sump for carrying a quantity of toner;  
a toner agitator mounted in said sump; and  
a single encoded wheel rotating in relation to said toner agitator, said encoded wheel including a coding for determining a quantity of toner in said cartridge.



Lexmark E220, E320/E322, and E321/E323 Cartridges

4

UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION

LEXMARK INTERNATIONAL, INC.

Plaintiff,

v.

INK TECHNOLOGIES PRINTER SUPPLIES, LLC, ET AL.

Defendants.

Civil Action No.  
1:10-CV-564-MRB

**FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT**

Plaintiff Lexmark International Inc. (“Lexmark”) for its first amended complaint against Defendants Blue Trading LLC; Core Servicios Informaticos S.I.; Direct Billing International Incorporated d/b/a Office Supply Outfitters; ECOI US Supplies, Inc.; Eco Service China Ltd.; Enviro Green Technologies; Exprint International, Inc.; FBA Holding, Inc. d/b/a Core Recovery Company, Unitone Imaging Supply, Unitone Imaging Group, Martek Supply Source, Imcopex America, Velox Systems, Inc., and International Digital Solutions; Fuller International Corporation; Green Imaging Supplies, Inc.; Green Project, Inc.; IJSS, Inc. d/b/a TonerZone.com and Ink Jet Superstore; Impression Products, Inc.; Interseroh Product Cycle GmbH; K & W International Development, Inc. d/b/a K&W Imaging Inc.; LD Products, Inc. d/b/a 4inkjets.com, Monstertoner.com, Inkcartridges.com, Inkcartridge.com, and 123inkjets.com; MBC Trading, Inc.; N & L Global Co. d/b/a N & L Global Corporation; NGS S.A.; Onlinetechstores.com, Inc. d/b/a Supplierswholesalers.com; Prinko Image Co. (USA), Inc.; Printronic Corporation; Recyca BVBA; Refiltoner; Shanghai Orink Infotech International Co., Ltd.; Standard Image USA, Inc.

d/b/a Imaging Standard Inc.; Tech Optics, Inc.; Tesen Development (Hong Kong) Co. Ltd.; Wal Group LLC; XSE Group, Inc. d/b/a Image Star; and Zhuhai Richeng Development Co., Ltd., states as follows:

### **NATURE OF CASE**

1. This is an action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. § 1 *et seq.*, and particularly 35 U.S.C. §§ 271 and 281.

2. A parallel complaint in the United States International Trade Commission (“ITC”) for an investigation under Section 337 of the Tariff Act of 1930, 19 U.S.C. § 1337, was contemporaneously filed with Lexmark’s original complaint in this action based upon the unlawful importation into the United States, the sale for importation and/or the sale within the United States after importation, of unauthorized, aftermarket toner cartridges, which are complained of herein, for use with Lexmark printers. *In the Matter of Certain Toner Cartridges and Components Thereof*, Inv. No. 337-TA-740 (International Trade Commission).

3. On September 27, 2011, the ITC determined that the Respondents identified in the ITC complaint (*i.e.*, the Defendants named in Lexmark’s original complaint in this action) infringed Lexmark’s patents. (Exhibit 1). The ITC entered a General Exclusion Order prohibiting, *inter alia*, the importation of toner cartridges and components thereof that are covered by one or more of Lexmark’s asserted patent claims. (Exhibit 2). The ITC also entered Cease and Desist Orders prohibiting the Defendants named in Lexmark’s original complaint from importing, making, advertising, distributing, and transferring toner cartridges and components thereof that are covered by one or more of Lexmark’s asserted patent claims. (*Id.*).

UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
WESTERN DIVISION

Lexmark International, Inc.,

Plaintiff,

v.

Case No. 1:10cv564

Ink Technologies Printer Supplies,  
LLC, *et al.*,

Judge Michael R. Barrett

Defendants.

**CIVIL MINUTES**

Motion hearing

before the

HONORABLE MICHAEL R. BARRETT, U.S. DISTRICT JUDGE

COURTROOM DEPUTY: Barbara Crum

LAW CLERK: Lindsay Potrafke

COURT REPORTER: Maryann Maffia, Official

DATE: June 17, 2013 Time: Commenced 9:38 Concluded 5:24 Total 2:16

Attorney for Plaintiff(s): Jason Schull  
Tim Meece  
Tim Haugh (IT) v. Bryan Medda  
Audra Eidem-Heinze  
Steven Loy  
Attorney for Defendant(s): John Hokanson  
Thomas Kiddle  
David Kern  
Tlan Douek (Rep)

**PROCEDURES**

☒ Counsel Present  
☒ Matter(s) heard on Motion for Contempt (Doc. 124)  
\_\_\_\_ Court's decision to follow.  
\_\_\_\_ Court ordered in open court that:

IT Witness

Andrew Gardner

Remarks: Parties to provide Court w/entry.

UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
EASTERN DIVISION

|                                   |   |                          |
|-----------------------------------|---|--------------------------|
| LEXMARK INTERNATIONAL, INC.,      | ) | CASE NO. 1:10 CV 564 MRB |
|                                   | ) |                          |
| Plaintiffs,                       | ) | JUDGE MICHAEL BARRETT    |
|                                   | ) |                          |
| INK TECHNOLOGIES PRINTER SUPPLIES | ) | MOTION TO DISMISS OF     |
| LLC, et al.,                      | ) | DEFENDANT IMPRESSION     |
|                                   | ) | PRODUCTS, INC.           |
| Defendants.                       | ) |                          |

Defendant Impression Products, Inc., (“Impression”), by and through counsel, respectfully moves this Court for an order dismissing the claims against it, pursuant to Rule 12(b)(6) of the FRCP, failure to state a claim upon which relief can be granted. The reasons for this Motion are more fully set out in the accompanying Memorandum in Support.

Respectfully submitted,

/s/ George H. Carr

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and



## **MEMORANDUM IN SUPPORT**

### **I. INTRODUCTION**

This case is essentially a one issue case as it applies to the vast majority, if not all of the defendants. The issue is whether or not the first sale extinguishment of patent rights applies if that first sale occurs in a country other than the United States.

While the complaint uses a shotgun approach in its allegations of infringement, by charging all of the defendants with every kind of infringement allowed under the patent statutes, the reality is that the relevant description of the accused products is that they are remanufactured products.<sup>1</sup> The remanufactured products at issue were allegedly first sold outside of the United States (primarily in Canada), by Plaintiff. They were then acquired by a Canadian defendant which in turn sold them to the other defendants in this case, who in turn sold them to others.

The movant, herein, is one of the defendants who is accused of purchasing remanufactured products, which were originally sold by Plaintiff, as new products, outside United States. The allegations set forth in paragraph 5 accuse all the defendants of importing, selling and/or offering remanufactured products for sale.

As will be set forth, *infra*, the legal basis for asserting infringement against remanufactured products, which were first sold outside of the United States, has been effectively overturned by a recent United States Supreme Court decision.

---

<sup>1</sup> Remanufactured products, in particular remanufactured inkjet cartridges, are spent or used cartridges which were originally sold by the manufacturer as new original cartridges and which were thereafter refilled; repaired as necessary; and then resold by other parties. Plaintiff will not contest that its allegations of patent infringement against Impressions Products are in fact directed to Impressions Products allegedly selling remanufactured products.

**II. UNDER CURRENT LAW, A PARTY WHICH SELLS A PATENTED PRODUCT, REGARDLESS OF THE COUNTRY IN WHICH IT FIRST SELLS THAT PRODUCT, HAS ALL OF ITS PATENT RIGHTS EXTINGUISHED UPON THAT FIRST SALE.**

It is long and well-established law that when a person sells a product, which is patented, it loses its rights to further assert its patents against anyone who makes use of that product, including selling it and repairing it. The case which specifically applied that the doctrine to the ink jet cartridge industry is *Hewlett-Packard v. Repeat-O-Type Stencil Manufacturing Corporation, Inc.*, 123 F.3d 1445 (Fed. Cir. 1997). Accordingly, under *Repeat-O-Type*, the use and sale of remanufactured products is perfectly legal and cannot be patent infringement.

In 2001, the Federal Circuit decided the case of *Jazz Photo Corp. v. United States International Trade Commission*, 264 F.3d 1094 (Fed. Cir. 2001). In its decision the Court stated that the on sale bar doctrine did not apply, if the first sale of the remanufactured product occurred in a country other than the United States. It is that decision upon which Plaintiff's entire case is based. Accordingly, the threshold issue for this Court to decide is whether or not *Jazz Photo* is still the operative law, or whether it has been overturned by the recent U.S. Supreme Court decision in the case of *Kirtsaeng v. John Wiley and Sons, Inc.*, 133 S. Ct. 1351 (2012).

In *Kirtsaeng* the Court ruled that the first sale extinguishment of copyright rights is not limited to sales in the United States. The question, as relates to this case, is whether the decision relating to first sale extinguishment of copyright rights, based on foreign sales, is also applicable to the extinguishment of patent rights, because of first sales in other countries.

A clear reading of the language and the rationale applied by the Court makes it clear that there is no reason to distinguish between patent rights, copyright rights, or any other rights in the products sold.

{00595339; 1; 1141-0001}

UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION

**LEXMARK INTERNATIONAL, INC.**

**Plaintiff,**

**v.**

**INK TECHNOLOGIES PRINTER SUPPLIES,  
LLC, ET AL.**

**Defendants.**

**Case No. 1:10-CV-564-MRB**

**JUDGE MICHAEL BARRETT**

**DEFENDANT IMPRESSION  
PRODUCTS, INC.'S SECOND  
MOTION TO DISMISS**

Defendant Impression Products, Inc., (“Impression”), by and through counsel, respectfully moves this Court for an order dismissing the claims against it, pursuant to Rule 12(b)(6) of the FRCP, failure to state a claim upon which relief can be granted. The reasons for this Motion are more fully set out in the accompanying Memorandum in Support.

Respectfully submitted,

/s/ Edward F. O'Connor

Edward F. O'Connor

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and

### MEMORANDUM IN SUPPORT

Defendant Impression previously filed a motion to dismiss Lexmark's case to the extent that it accuses the sale of remanufactured cartridges, which cartridges were first sold out side of the United States, as infringing cartridges. Lexmark bases its case on the *Jazz Photo* decision of the Federal Circuit, which held that first sale extinguishment of patent rights only applies if the first sale occurs within the United States. That was a decision which was on shaky grounds when it was decided. The recent decision of the United States Supreme Court in the *Kirtsaeng v. John Wiley and Sons, Inc.*, 133 S. Ct. 1351 (2012), made it very clear that there was no legal basis for continuing to uphold *Jazz Photo*.

In its opposition to that motion to dismiss, Lexmark informed this Court and that it was not only pursuing remanufactured cartridges, which cartridges were initially sold outside of the United States, but that it was also pursuing cartridges under its pre-bate program. Lexmark cited this Court to a decision of the Sixth Circuit, *Static Control Components, Inc. v. Lexmark International, Inc.*, 697 F.3d 387 (6<sup>th</sup> Cir. 2012), wherein the Sixth Circuit declined to decide the validity of the pre-bate program. The pre-bate program restricts purchasers of its cartridges from buying refurbished or replacement cartridges from anyone but *Lexmark*. *Quanta v. LG Electronics*, 553 U.S. 617; 125 S. Ct. 2109 (June 2008), prohibits patentees from restricting use of patented products once sold.

Impression, in its reply brief, cited this Court to the initial decision by the District Court in *Static Control Components, Inc. v. Lexmark International, Inc.*, 615 F. Supp. 2d 575, 588 (E.D. KY, March 2009).

The District Court had originally upheld the validity of the pre-bate program, but, after the United States Supreme Court entered its decision in *Quanta*, the Court determined that



**UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION**

**LEXMARK INTERNATIONAL, INC.**

**Plaintiff,**

**v.**

**INK TECHNOLOGIES PRINTER SUPPLIES,  
LLC, ET AL.**

**Defendants.**

**Case No. 1:10-CV-564-MRB**

**JUDGE MICHAEL BARRETT**

**DEFENDANT IMPRESSION PRODUCTS, INC.'S REPLY TO PLAINTIFF LEXMARK  
INTERNATIONAL, INC.'S RESPONSE IN OPPOSITION TO ITS SECOND MOTION  
TO DISMISS**

As noted by Defendant Impression Products, in its motion, the District Court decision in Kentucky is the only decision, subsequent to the Supreme Court decision in *Quanta*, to decide the issue of whether or not Lexmark's pre-bate program is enforceable under the United States patent laws in light of the decision in *Quanta*. That Court decided that it was not. As correctly noted by Lexmark, the Sixth Circuit declined to address the decision explaining that the question of exhaustion, in that case, was extremely complex and unsettled.

Accordingly, it will be up to this Court to determine whether or not it is in agreement with the decision of the Kentucky District Court regarding the pre-bate program.

Lexmark relies heavily on the Federal Circuit decision in *Mallinckrodt* to support its position that it has an absolute right to impose a single use restriction, under the United States patent laws, on consumers. *Mallinckrodt* says no such thing. In *Mallinckrodt* the issue was whether or not any restriction on use of a patented product was void as a matter of law. The court



held that all such restrictions are not per se invalid. It did not say that all such restrictions are valid. In *Mallinckrodt*, the plaintiff was asserting that the single use restriction was appropriate for health and safety reasons. The Court cited to other cases which upheld such restrictions for health and safety purposes. The Court then remanded the case for a determination as to whether or not, under the facts in that case, the single use restriction was reasonable and proper.

The significance of *Quanta* was that the Supreme Court invalidated a use restriction. It did so, under the facts that case, because the restriction, sought to be imposed by the patentee, would have interfered with the normal and intended use of the patented product. The Court did not say that those were the only conditions under which a use restriction would be invalid.

In the case at bar, Lexmark is attempting to enforce, under the patent laws (Lexmark is not asserting any contract causes of action in this case) a single use restriction, which is intended solely for the purpose of allowing Lexmark to prevent competition with its products. Lexmark does not even attempt to assert that there are any reasons, such as health or safety or product safety to justify its single use restriction. Lexmark does not present any allegations that members of the consuming public are ever made aware of the fact that they are purchasing products subject to the single use restriction which they are now attempting to assert in this case.

None of the cases cited by Lexmark related to this specific type of license asserted in this case. For example, *General Talking Pictures Corp. v. W. Elec. Co.*, 304 US 175, 181 (1938) is about a restriction on use where the purchasers of the patented product were clearly aware of the fact that those products were for private use only and were not authorized to be sold for commercial use. That was a restriction on the type of use. It was not a single use license for the general consuming public, such as is presented in this case.

*Printco. Corp. v. Int’l Trade Comm’n*, 616 F3d 1318, 1328 (Fed. Cir. 2010) involved field of use restrictions. *Monsanto Co. v. Bowman*, 657 F3d 1341, 1347 (Fed. Cir. 2011) was a case involving seeds, in which the Court determined that using patented seeds to create new seeds was patent infringement.

*Fujifilm Corp. v. Benun*, 605 F.3d 1366, 1371-72 (Fed. Cir. 2010) determined that *Jazz Photo* was not overturned by *Quanta*.

*Arizona Cartridge Remanufacturers Assoc. Inv. v. Lexmark International Inc.*, 421 F3d 981 (9<sup>th</sup> Cir. 2005) was decided well before *Quanta* and before the District Court in Kentucky decided that the pre-bate program was not enforceable under U.S. patent law. In any event, that was a Ninth Circuit decision, not a decision of the Federal Circuit or the United States Supreme Court.

The decision by the Federal Court in Kentucky was a case of first impression, involving Lexmark's pre-bate program, subsequent to the United States Supreme Court decision in *Quanta*. Defendant Impression Products, Inc. is of the opinion that that Court's decision was correct and that it should be followed by this Court. The pre-bate restriction is one which has been imposed upon unsuspecting consumers for the sole purpose of restricting the ability of Lexmark to maintain a monopoly on cartridges for use with its printers, and not for any valid patent related purpose. Under *Mallinckrodt*, the appropriate inquiry is whether this is a proper restriction.

As discussed in Impression's Reply to Lexmark's opposition to its motion to dismiss, *Mallinckrodt* does not stand for the proposition that, any and all, such restrictions are legal and enforceable under patent law. It requires an analysis to determine if the restriction is for a proper or an improper purpose. In this case, it is obvious that the only purpose is to enable Lexmark to establish a monopoly over its cartridges by preventing anyone else from refurbishing its cartridges after they have been sold to members of the public. The other stated purposes are fact assertions, and in any event do not pass the straight face test.

1. Lexmark's commitment to the environment. According to the restrictive license, the spent cartridges can only be returned to Lexmark, and no others. Since there is no incentive for any consumer to return the cartridges to Lexmark, they will throw them away, thus adding more plastic to the landfills.

2. Protecting consumers and accordingly Lexmark's reputation, from inferior cartridges remanufactured by third parties. Unless those third parties are guilty of trademark infringement, there is no reason whatsoever to believe that inferior cartridges remanufactured by others will in any way impact Lexmark's reputation.

3. Obtaining empty cartridges for remanufacturing by Lexmark. The only reason Lexmark wants to have those empty cartridges remanufactured by it, is to eliminate competition. In fact, since nothing in the license requires that the empty cartridges be returned to Lexmark, and since there is no apparent advantage to consumers in returning the cartridges to Lexmark, there is no reason to believe that empty cartridges will in fact ever be returned to Lexmark. If Lexmark is successful in its efforts, its spent cartridges will be thrown away and no one will be able to provide remanufactured Lexmark cartridges. Consumers will be left with no choice but to

purchase new cartridges from Lexmark, which is Lexmark's sole objective in attempting to abrogate the basic legal principle of patent exhaustion. This is an improper purpose, and should not be countenanced by this Court.

October 22, 2013

Respectfully submitted,

/s/ Edward F. O'Connor  
Edward F. O'Connor  
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**UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION**

LEXMARK INTERNATIONAL, INC.

Plaintiff,

V.

INK TECHNOLOGIES PRINTER SUPPLIES, LLC, ET AL.

Defendants.

Civil Action No.  
1:10-CV-564-MRB

## SECOND AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Lexmark International Inc. (“Lexmark”) for its second amended complaint against Defendants Blue Trading LLC; Core Servicios Informaticos S.I.; Direct Billing International Incorporated d/b/a Office Supply Outfitters; Eco Service China Ltd.; Eco Service Sp. z o.o.; Enviro Green Technologies; Exprint International, Inc.; FBA Holding, Inc. d/b/a Core Recovery Company, Unitone Imaging Supply, Unitone Imaging Group, Martek Supply Source, Imcopex America, Velox Systems, Inc., and International Digital Solutions; Green Project, Inc.; Hock Group LLC d/b/a ProfessorInk.com; Impression Products, Inc.; Interseroh Product Cycle GmbH; LD Products, Inc. d/b/a 4inkjets.com, Monstertoner.com, Inkcartridges.com, Inkcartridge.com, and 123inkjets.com; LTS Consumables, Inc.; MBC Trading, Inc.; N & L Global Co. d/b/a N & L Global Corporation; NGS S.A.; Onlinetechstores.com, Inc. d/b/a Supplierswholesalers.com; OW Supplies Corp. d/b/a www.officewarehousesupplies.com; Prinko Image Co. (USA), Inc.; Recyca BVBA; Refiltoner; Shanghai Orink Infotech International Co., Ltd.; Sinotime Technologies, Inc. d/b/a 2Stoner.com; Tech Optics, Inc.; Tesen Development

(Hong Kong) Co. Ltd.; TonerLand; Zhuhai Aicon Image Co., Ltd.; and Zhuhai Richeng Development Co., Ltd., states as follows:

### **NATURE OF CASE**

1. This is an action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. § 1 *et seq.*, and particularly 35 U.S.C. §§ 271 and 281.

2. A parallel complaint in the United States International Trade Commission (“ITC”) for an investigation under Section 337 of the Tariff Act of 1930, 19 U.S.C. § 1337, was contemporaneously filed with Lexmark’s original complaint in this action based upon the unlawful importation into the United States, the sale for importation and/or the sale within the United States after importation, of unauthorized, aftermarket toner cartridges, which are complained of herein, for use with Lexmark printers. *In the Matter of Certain Toner Cartridges and Components Thereof*, Inv. No. 337-TA-740 (International Trade Commission).

3. On September 27, 2011, the ITC determined that the Respondents identified in the ITC complaint (*i.e.*, the Defendants named in Lexmark’s original complaint in this action) infringed Lexmark’s patents. (Exhibit 1). The ITC entered a General Exclusion Order prohibiting, *inter alia*, the importation of toner cartridges and components thereof that are covered by one or more of Lexmark’s asserted patent claims. (Exhibit 2). The ITC also entered Cease and Desist Orders prohibiting the Defendants named in Lexmark’s original complaint from importing, making, advertising, distributing, and transferring toner cartridges and components thereof that are covered by one or more of Lexmark’s asserted patent claims. (*Id.*).



4. Since the filing of Lexmark's original complaint in this action, the Court has entered Stipulated Permanent Injunction Orders against the Defendants named in the original complaint, certain of the Defendants named in the first amended complaint, as well as numerous John Doe Defendants. (*See* D.E. 85, 87, 90, 91, 93, 96, 97, 100, 101, 103, 105, 114, 122, 129-134, 146-152, 157-159, 164, 176-181, 184, 185, 188, 189, 194-196, 199-201, 212, 214, 227, 280, 281, 297, 304, 350, 351, 358-361, 411, 417). The Stipulated Injunction Orders prohibit, *inter alia*, the manufacture, use, sale, offer for sale or importation into the United States toner cartridges that infringe Lexmark's asserted patent claims. (*See id.*).

### **THE PARTIES**

#### **Plaintiff – Lexmark International Inc.**

5. Lexmark is a Delaware corporation with its principal place of business in Lexington, KY. Lexmark is a leading worldwide developer, manufacturer, and supplier, of *inter alia*, of laser printers and toner cartridges.

6. Lexmark develops and owns most of the technology for its laser printers and associated supplies. This differentiates Lexmark from a number of its major competitors.

7. Lexmark's research and development activity for the past several years has focused on, *inter alia*, laser printers and printer supplies. The process of developing new technology products is complex and requires innovative designs that anticipate customer needs and technological trends. Lexmark's research and development expenditures were \$375 million in 2009, \$423 million in 2008, \$401 million in 2007, \$371 million in 2006, \$336 million in 2005, \$312 million in 2004, \$266 million in 2003, \$247 million in 2002, \$246 million in 2001, \$217 million in 2000, and \$184 million in 1999.

8. Over the years, Lexmark has developed numerous models of monochrome laser printers, including the E120, E220, E230, E232, E234, E238, E240, E250, E260, E320, E322, E321, E323, E330, E332, E340, E342, E350, E352, E360, E450, E460, E460, T520, T522, X520, X522, T610, T612, T614, T616, T620, T622, X620, T630, T632, T634, T640, T642, T644, T650, T652, T654, T656, X650, X651, X652, X653, X654, X655, and X656 series printers, and the equivalent monochrome laser printers sold under private label, including the Dell 1700, Dell 1700N, Dell 1710, Dell 1720, Dell 2230, Dell 2330, Dell 235 Technologies 0, Dell 3330, Dell 3333, Dell 3335, Dell 5200, Dell 5210, Dell 5300, Dell 5310, Dell 5230, Dell 5350, Dell 5530, Dell 5535, Dell E220, IBM 1116, IBM 1312, IBM 1412, IBM 1512, IBM 1512N, IBM infoPrint 1120, IBM InfoPrint 1125, IBM Infoprint 1130, IBM Infoprint 1140, IBM InfoPrint 1332, IBM Infoprint 1352, IBM Infoprint 1372, IBM InfoPrint 1532, IBM Infoprint 1552, IBM Infoprint 1572, IBM Infoprint 1832, IBM Infoprint 1850, IBM Infoprint 1852, IBM Infoprint 1860, IBM Infoprint 1870, IBM Infoprint 1872, IBM Infoprint 1880, IBM Infoprint 1892, InfoPrint 1601, InfoPrint 1602, InfoPrint 1612, InfoPrint 1622, Infoprint 1822, IBM Infoprint 1823, IBM Infoprint 1930, IBM Infoprint 1940, Lenovo LI3900, LG 3510, LG 3350, LG 3850, LG 4010, Nashuatec P6220, Nashuatec P6225, Nashuatec P6230, Nashuatec 6240, Okidata MB780, Okidata MB790, Okidata 5500, Okidata 7180, Okidata 7190, Ricoh Afficio SP 4400, Ricoh Afficio SP 4410, Ricoh Afficio SP 4420, Sindoricoh 5000, Sindoricoh 5005, Sindoricoh 5050, Sindoricoh 4450, Sindoricoh 4550, Sindoricoh 4555, Sindoricoh 5450, Sindoricoh 5550, Source Technologies 9116, Source Technologies 9130, Source Technologies 9140, Source Technologies 9325, Source Technologies 9335, Source Technologies 9340, Source Technologies 9530n, Source Technologies 9550, Source Technologies 9552, Source Technologies 9630, Source Technologies 9650, Source Technologies 9620, Source

Technologies 9622, Source Technologies ST 9120, Source Technologies 9125, Toshiba e-Studio 20P, Toshiba e-Studio 25P, Toshiba e-Studio 30P, Toshiba e-Studio 40P, Toshiba e-Studio 400P, Toshiba e-Studio430, Toshiba e-Studio 530, Toshiba e-Studio 450P, Toshiba e-Studio 500P, Toshiba e-Studio 500P, Unisys 134, Unisys 136, Unisys UDS 130, Unisys UDS 132, Unisys UDS 640n, Unisys UDS 650n, Unisys UDS 140, Unisys UDS 142, Unisys UDS 540n, Unisys UDS 544n, Unisys UDS 630, Unisys UDS 635dn series printers.<sup>1</sup> In addition, Lexmark has designed and developed toner cartridges for each of these laser printer models and equivalents sold under private label.

9. Lexmark is the assignee and owner of a number of United States patents that cover various aspects of its toner cartridges including, for example, the “Patents-in-Suit,” which are set forth below. True and correct copies of the Patents-in-Suit are attached as Exhibits 4 - 24.

| United States Pat. No.        | Title   | Exhibit |
|-------------------------------|---|---------|
| 5,337,032 (“the ‘032 Patent”) | Reduced Component Toner Cartridge   | 4       |
| 5,634,169 (“the ‘169 Patent”) | Multiple Function Encoder Wheel For Cartridges Utilized In An Electrophotographic Output Device | 5       |
| 5,758,231 (“the ‘231 Patent”) | Venting Plug In Toner Cartridge   | 6       |
| 5,758,233 (“the ‘233 Patent”) | Toner Cartridge With Locating [Surfaces] On Photoconductor Shaft                                | 7       |
| 5,768,661 (“the ‘661 Patent”) | Toner Cartridge With External Planar Installation Guides  | 8       |
| 5,802,432 (“the ‘432 Patent”) | Toner Cartridge with Housing and Pin Construction   | 9       |
| 5,875,378 (“the ‘378 Patent”) | Toner Cartridge With Hopper Exit Agitator   | 10      |
| 5,995,772 (“the ‘772 Patent”) | Imaging Apparatus Cartridge Including An  | 11      |

<sup>1</sup> Exhibit 3 attached hereto is a chart identifying which laser printer models sold under private label are equivalent to Lexmark’s laser printer models.

| United States Pat. No.        | Title   | Exhibit |
|-------------------------------|---|---------|
|                               | Encoded Device  |         |
| 6,009,291 (“the ‘291 Patent”) | Control Of Photosensitive Roller Movement                               | 12      |
| 6,078,771 (“the ‘771 Patent”) | Low Friction Doctor Blade   | 13      |
| 6,397,015 (“the ‘015 Patent”) | Encoded Device Having Positioned Indicia For Use With A Toner Cartridge | 14      |
| 6,459,876 (“the ‘876 Patent”) | Toner Cartridge   | 15      |
| 6,487,383 (“the ‘383 Patent”) | Dynamic End-Seal For Toner Development Unit                             | 16      |
| 6,496,662 (“the ‘662 Patent”) | Optical Toner Low Sensor  | 17      |
| 6,678,489 (“the ‘489 Patent”) | Two Part Cartridges With Force Biasing By Printer                       | 18      |
| 6,816,692 (“the ‘692 Patent”) | Support Assembly For Roller Including Roller Body And Support Shaft     | 19      |
| 6,871,031 (“the ‘031 Patent”) | Coupling Mechanism For A Two Piece Printer Cartridge                    | 20      |
| 6,879,792 (“the ‘792 Patent”) | Two Part Cartridges With Force Biasing By Printer                       | 21      |
| 7,139,510 (“the ‘510 Patent”) | Two Part Cartridges With Force Biasing By Printer                       | 22      |
| 7,233,760 (“the ‘760 Patent”) | Method and Device for Doctor Blade Retention                            | 23      |
| 7,305,204 (“the ‘204 Patent”) | Two Part Cartridges With Force Biasing By Printer                       | 24      |

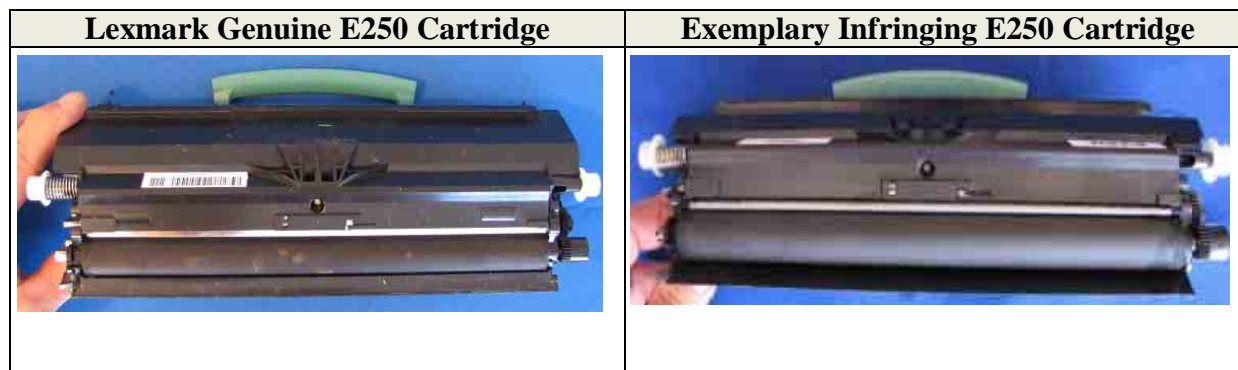
10. The Patents-In-Suit are valid and enforceable. In fact, myriad Defendants and John Doe Defendants have expressly agreed to the validity and enforceability of the Patents-in-Suit in court filings, public statements, and confidential settlement agreements.

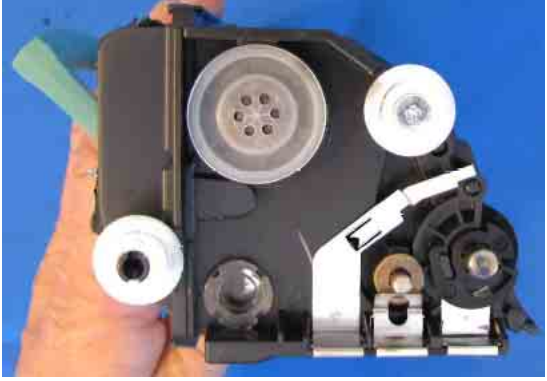





#### **Defendants Generally**

11. Defendants remanufacture, manufacture, sell for importation, import, distribute, offer to sell, and/or sell unauthorized aftermarket toner cartridges, developer assemblies, and photoconductor assemblies that are intended as substitutes for use with one or more of

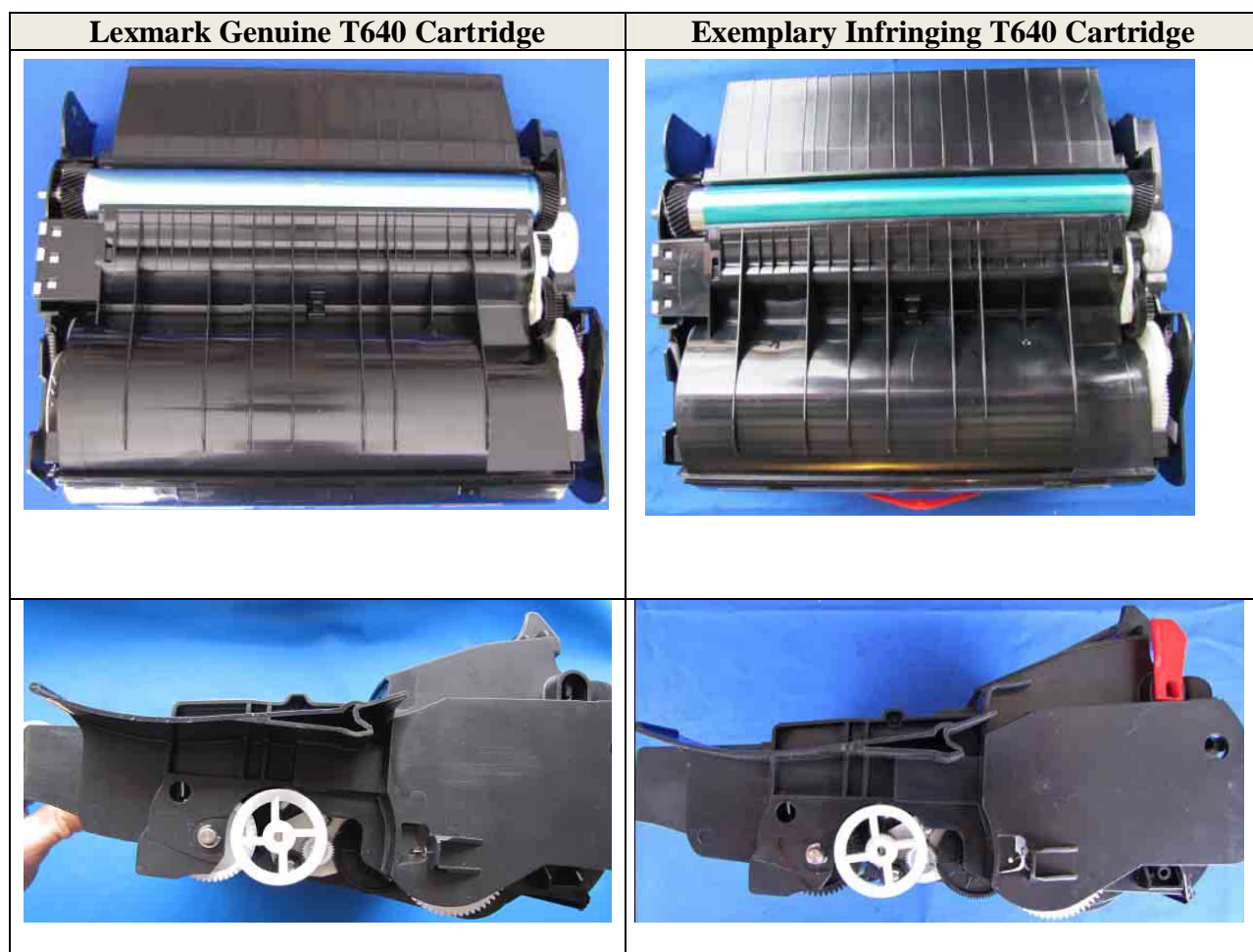
Lexmark's E120, E220, E230, E232, E234, E238, E240, E250, E260, E320, E322, E321, E323, E330, E332, E340, E342, E350, E352, E360, E450, E460, E460, T520, T522, X520, X522, T610, T612, T614, T616, T620, T622, X620, T630, T632, T634, T640, T642, T644, T650, T652, T654, T656, X650, X651, X652, X653, X654, X655, and/or X656 laser printer series and the equivalent laser printer models sold under private label identified in Paragraph 8 above and in Exhibit 3, including clones as well as remanufactured versions of these cartridges and assemblies that originally were first sold outside of the United States (collectively, "the Accused Cartridges").

12. The clone and remanufactured versions of these Accused Cartridges have the same patented components as Lexmark's original, patented components. This can be seen, for example, by the following exemplary side-by-side comparison of Lexmark's patented E250 cartridge to an exemplary infringing E250 cartridge, and side-by-side comparison of Lexmark's patented T640 cartridge to an exemplary infringing T640 cartridge:



| Lexmark Genuine E250 Cartridge  | Exemplary Infringing E250 Cartridge  |
|---|--|
|    |    |
|   |   |
| Lexmark Genuine T640 Cartridge  | Exemplary Infringing T640 Cartridge  |
|  |  |





13. The clone cartridges are mere copies of Lexmark's genuine toner cartridges and for a particular model and blatantly duplicate the components of Lexmark's patented toner cartridges. Likewise, the remanufactured cartridges first sold outside the United States are, in all relevant respects, identical to Lexmark's patented toner cartridges. In other words, the remanufactured versions continue to practice Lexmark's patents just as when those cartridges were originally manufactured and sold by Lexmark.

14. For example, this can be seen by the below side-by-side comparison of Lexmark's patented encoder wheels, disclosed and claimed in Lexmark's '015 patent, to encoder wheels taken from infringing cartridges.



PAGES A2353 - A2566 REMOVED DUE TO CONFIDENTIAL MATERIAL

**UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION**

**LEXMARK INTERNATIONAL, INC.**

**Plaintiff,**

**v.**

**INK TECHNOLOGIES PRINTER SUPPLIES,  
LLC, ET AL.**

**Defendants.**

**Case No. 1:10-CV-564-MRB**

**JUDGE MICHAEL BARRETT**

**NOTICE OF APPEAL**

Notice is hereby given that Defendant Impression Products, Inc. ("Impression") hereby appeals to the United States Court of Appeals for the Federal Circuit from this Court's Stipulated Final Judgment dated and entered in this action on June 24, 2014 [Dkt. 670] a copy of which is attached hereto as Exhibit A.

Dated: June 26, 2014

Respectfully submitted,

/s/ Edward F. O'Connor

Edward F. O'Connor

*ADMITTED PRO HAC VICE*

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### **CERTIFICATE OF SERVICE**

This is to confirm that a copy of the foregoing was electronically filed on June 26, 2014.

A true and accurate copy of the foregoing will be served electronically to designated

CM/ECF participant counsel through the Court's electronic filing system.

/s/ Edward F. O'Connor  
*Attorney for Impression Products, Inc.*



UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
CINCINNATI DIVISION

LEXMARK INTERNATIONAL, INC.

Plaintiff,

v.

INK TECHNOLOGIES PRINTER SUPPLIES, LLC, ET AL.

Defendants.

Civil Action No.  
1:10-CV-564-MRB

**NOTICE OF APPEAL**

Notice is hereby given that Plaintiff Lexmark International, Inc. in the above-named case hereby appeals to the United States Court of Appeals for the Federal Circuit from the Stipulated Final Judgment entered in this action on June 24, 2014, (ECF No. 670) with respect to the Opinion and Order of March 27, 2014, on Defendant Impression Products, Inc.'s Second Motion to Dismiss (ECF No. 615), and from all prior orders, judgments, and rulings entered in this action.

Respectfully submitted,

Dated: June 27, 2014

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**CERTIFICATE OF SERVICE**

This is to confirm that a copy of the foregoing was electronically filed on June 27, 2014. A true and accurate copy of the foregoing will be served electronically to designated CM/ECF participant counsel through the Court's electronic filing system.

s/ Audra C. Eidem Heinze  
Attorney for Lexmark International, Inc.

UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF OHIO  
WESTERN DIVISION

- - -

LEXMARK INTERNATIONAL, INC.,. CASE NO. 1:10-CV-564

Plaintiff,

- v -

INK TECHNOLOGIES PRINTER,  
SUPPLIES, LLC, et al.,

Defendants.

. . . . .

*Hearing on Motion for Contempt*

9:40 A.M.

Monday, June 17, 2013

Cincinnati, Ohio

TRANSCRIPT OF PROCEEDINGS  
BEFORE THE HONORABLE MICHAEL R. BARRETT

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1           **Also present:**                   **Mr. Ilan Douek**  
2   **Tim Haugh, IT Technician**  
3           **Law Clerk:**                   **Lindsay Potrafke, Esq.**  
4           **Courtroom Deputy:**       **Barbara A. Crum**  
5           **Court Reporter:**       **Maryann T. Maffia, RDR**  
6   **239 Potter Stewart U.S. Courthouse**  
7   **100 East Fifth Street**  
8   **Cincinnati, Ohio 45202**  
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1 Lexmark's cartridges, and they infringe Lexmark's cartridges  
2 unless there is patent exhaustion.

3 IJSS in its brief at page 14 admitted that, according to  
4 the law of the Federal Circuit, it is its burden of proof to  
5 quote -- or its burden of proof is to show patent exhaustion.  
6 "Patent exhaustion is an affirmative defense for which IJSS  
7 has the burden of proof." They admit that.

8 What evidence are we going to see that there was any  
9 patent exhaustion for any of the 3,121 of the cartridges that  
10 it sold through November of 2012? You're not going to see  
11 anything at this hearing. There will be absolutely no  
12 evidence of exhaustion presented.

13 Now, it's not our burden to show a lack of patent  
14 exhaustion. We don't have to disprove the negative. However,  
15 we can show substantial evidence that our patent rights were  
16 not exhausted.

17 One of the ways that we can do this is to start here with  
18 Lexmark's worldwide brand protection strategy. Mr. Gardner,  
19 Lexmark's corporate witness here today, is the Worldwide Brand  
20 Protection Manager for Lexmark. He will testify that as part  
21 of Lexmark's brand protection strategy they regionalize their  
22 cartridges. What that means is that a cartridge sold for use  
23 in one region is only meant to work with printers sold for use  
24 in that same region. You can't mix and match a cartridge sold  
25 for use in Latin America with a printer sold for use in North

1 America. If you try to do that, the cartridge won't work.

2 Lexmark does this to protect against grey market supplies  
3 and counterfeit products. By "grey market," we mean there may  
4 be situations where Lexmark has to do special bid pricing in  
5 one area of the world for one customer for some specific  
6 reason. They can't have that vendor then siphoning off  
7 product and shipping it to another area of the world. It  
8 causes problems.

9 It also opens up then channels. If they are doing that,  
10 it opens up channels through which counterfeit or fake or  
11 clone products can be channelled to an inappropriate venue.

12 So all this information is publicly available, publicly  
13 available on the Internet, and Lexmark's remanufacturers are  
14 well aware of it.

15 Here is one example. Region 4, which we have highlighted,  
16 which I'm going to touch our screen here to play, Region 4,  
17 that's Latin America. If you sell a cartridge into Latin  
18 America, then you try to import that cartridge into the United  
19 States, it won't work. It won't work in a U.S. printer.

20 It's known by Print After Print. Print After Print is the  
21 largest supplier, says that they know that cartridges ending  
22 with the suffix L in the part number are for Latin America,  
23 and that prevents the cartridge -- the chip on the cartridge  
24 then prevents the cartridge from being used with printers in  
25 other areas of the world.



1 suffix A, right there (indicating). That suffix A means North  
2 America. It corresponds to the Region 1 that we saw and the  
3 earlier chart.

4 Then we have this Lexmark serial number over here  
5 (indicating). That's a distinct serial number that Lexmark  
6 uses to track its cartridges.

7 All this information was concealed or destroyed. None of  
8 it was kept.

9 So what do we think you're going to hear from IJSS? What  
10 do we think that they are going to say? You're going to hear  
11 a series of excuses.

12 The first one probably is: Lexmark made me do it.

13 They're going to say Lexmark sent a letter to Mr. Sherman,  
14 Print After Print, in December of 2010. In that letter,  
15 Lexmark told Print After Print that it had a series of federal  
16 trademarks and it didn't want its trademarks to remain on any  
17 products that Print After Print was selling. Lexmark didn't  
18 want any consumers to be confused by the products that IJSS or  
19 Print After Print was selling. If there is a bad product and  
20 it's got a Lexmark trademark on it, the customer is going to  
21 assume, "Well, that was Lexmark. They gave me a bad product."  
22 So Lexmark asked them to not have any trademarks appear on the  
23 products that they were selling.

24 The letter never told Print After Print to destroy serial  
25 numbers. It never told them to destroy the chips. It never

1 THE COURT: Thank you.

2 Counsel.

3 MR. LOY: Thank you, Your Honor. May it please the  
4 Court.

5 ANDREW GARDNER

6 a witness herein, testified as follows:

7 DIRECT EXAMINATION

8 BY MR. LOY:

9 Q. Andrew, could you give the Court a sense of post-secondary  
10 degrees that you hold.

11 A. I have a bachelor's degree from Miami University, and I  
12 have a master's degree from Baldwin Wallace College.

13 Q. Okay. And when did your employment with Lexmark begin?

14 A. Started working for Lexmark in May of 1997.

15 Q. And what's your current position at Lexmark?

16 A. Current position is Worldwide Brand Protection Manager. I  
17 have responsibility for our corporate Anti-Counterfeit Grey  
18 Market Diversion and Supplies Intellectual Property programs.

19 Q. So as part of your job do you help enforce Lexmark's  
20 intellectual property rights?

21 A. I do, yes.

22 Q. Thank you. And how long have you had that particular  
23 position?

24 A. Since 2004.

25 Q. Okay. Now, if you could, for the Court, on a fairly

1 general level describe Lexmark's business.

2 A. Lexmark is primarily a printer manufacturer. Up until  
3 last year we manufactured ink jet printers and laser printers  
4 and the supplies that go with them. Last year we exited the  
5 ink jet business and now solely concentrate on the laser  
6 printer business. We have the -- we are one of the few  
7 printer companies that actually owns and develops its own  
8 laser printer engine technologies. The research and  
9 development for this is done in Lexington, so the prime thrust  
10 would be the laser printer market.

11 Q. Okay. How much does Lexmark on an annual basis typically  
12 invest in its research and development?

13 A. It's between three- and 400 million dollars per year.

14 Q. I think you heard in Mr. Meece's opening he referenced  
15 some awards that Lexmark has received for its technology.  
16 Could you give the Court a sense of the types and the number  
17 of awards Lexmark has received?

18 A. The awards we have received are from third-party  
19 evaluators such as *Buyers Lab*, *PC Magazine*, *Computer Magazine*.  
20 These awards are for the monochrome laser printers that we  
21 manufacture, awards that show, you know, that the printers  
22 perform very well in commercial and business environments.

23 Q. By monochrome, you are referring to --

24 MR. HOKANSON: Objection. Leading.

25 A. Monochrome --

1 THE COURT: It's a preliminary type of question, so  
2 -- there is no jury here, so overruled.

3 A. Monochrome printing, just -- printers that print just  
4 black as opposed to a color printer that print in color.

5 Q. Thank you. Does Lexmark obtain intellectual property  
6 rights on its technology.

7 A. We do. We have many patents on our printer engines, our  
8 printer technologies, as well as the cartridges that are used  
9 in tandem with those.

10 Q. And how important is Lexmark's intellectual property  
11 rights?

12 A. Without the intellectual property rights, you know, it  
13 would be very, very difficult for us to continue. You know,  
14 as was stated earlier, a vast a majority of the company's  
15 profits and revenue come from the sale of the patented printer  
16 cartridges.

17 Q. Lexmark produces, I think you testified, new cartridges.  
18 Does Lexmark also remanufacture its own cartridges?

19 A. We do. We have a -- our cartridge manufacturing facility  
20 in Juárez, Mexico, where we make new cartridges is also the  
21 location where we remanufacture cartridges. We have a  
22 cartridge collection program. These cartridges come from our  
23 customers. These are then taken to the facility in Juárez,  
24 Mexico. They are sorted, they are remanufactured to the same  
25 standards that we would use for manufacturing a new cartridge.

1 They use the same toner in the remanufactured cartridges that  
2 we use in the new cartridges, and then those are then sold to  
3 corporate customers who have a need for a cartridge at a  
4 slightly better price. Since the cartridge housing, the empty  
5 cartridge, is reused, we can then offer that at a slightly  
6 better price to a corporate user who, you know, perhaps in a  
7 warehouse environment or in a retail planogram environment  
8 where they are willing to accept a few tradeoffs versus a  
9 brand-new cartridge from Lexmark.

10 Q. What about cartridges or cartridge parts that cannot be  
11 remanufactured, what do you do with those?

12 A. Cartridges or cartridge parts that are not remanufactured,  
13 those are recycled into their component parts so that the  
14 plastics are ground up and sold as plastic waste. The metals  
15 are recycled and sold as metal waste so they can be turned  
16 into new things.

17 Q. Are there particular areas or channels where Lexmark has  
18 had success against its competitors?

19 A. One of the best markets for us as we look at, you know,  
20 vertical markets for our monochrome laser business has been  
21 the retail pharmacy market. We have better than 90 percent  
22 market share in the retail pharmacy market, and this is  
23 because of the printers' capabilities to print labels. One of  
24 the benefits of owning our own technology is that we can, you  
25 know, adjust the engine parameters, the fuser temperatures to

1 1720 printer would be the same or equivalent to the Lexmark  
2 E250 printer and printer cartridge.

3 Q. Thank you.

4 THE COURT: Steve, is this an agreed exhibit or one  
5 that's not?

6 MR. LOY: This is one of the exhibits that was not  
7 objected to, so it's been entered into the record.

8 THE COURT: Okay. Just do me a favor. Just  
9 reintroduce and we'll just say Agreed Exhibit 44 so that I  
10 know if there is one that we have to have a conversation  
11 about.

12 MR. LOY: Thank you, Your Honor. I will do that.

13 THE COURT: Okay. Thank you.

14 Q. Could you describe for the Court what the remanufacturing  
15 industry is, what it does?

16 A. The remanufacturing industry exists to -- they collect  
17 empty cartridges from our customers. They purchase empty  
18 cartridges from cartridge brokers. They then get the  
19 cartridges, they replace the toner, and they will replace the  
20 microchip. They will put a different label on the cartridge,  
21 put it in a box and then resell that through a variety of  
22 venues to customers who have a printer that would use a  
23 remanufactured cartridge.

24 Q. Okay. Are you familiar with the term "virgin core"?

25 A. I am. A virgin core or a virgin empty is a toner

1 cartridge that has been used once by a customer. A virgin  
2 core is a cartridge that has -- the first use was the customer  
3 using the, in this situation, a Lexmark-branded cartridge.  
4 Then once that cartridge gets consumed, it then gets either  
5 recycled by the consumer or collected by a cartridge broker.

6 Virgin cores or virgin empties are the preferred  
7 cartridges that remanufacturers like to use because the  
8 cartridge has not been remanufactured previously. Therefore,  
9 they know that the structure of the cartridge is whole and has  
10 not been modified in any way.

11 Q. So they are more valuable than cartridges that have been  
12 reused multiple times?

13 A. That is correct.

14 Q. Okay. Have you -- talk about the variation in quality  
15 between Lexmark-remanufactured cartridges and third-party-  
16 remanufactured cartridges and if you see any variation in the  
17 quality among third-party remanufacturers.

18 A. Lexmark-remanufactured cartridges are made to very high  
19 standards in the same facility where we make new cartridges.  
20 The same technicians who build our new cartridges may one day  
21 during the manufacturing process be tasked to build  
22 remanufactured cartridges. So the same people, the same level  
23 of expertise to build a new cartridge is used to build a  
24 remanufactured cartridge.

25 The toner that goes into our cartridges, both new and



1 remanufactured, is built, but the toner is built, created by  
2 us, by Lexmark, in its facility in Boulder, Colorado. The  
3 toners vary depending on the different printer model.  
4 Printers that print at a high rate of speed have a toner that  
5 melts at a different temperature. The fuser operates at a  
6 different temperature because the toner needs to be affixed to  
7 the page very quickly as opposed to a printer that prints at a  
8 lower speed so that the temperature of the fuser can be lower.

9 So we do have a lot of different steps and a lot of  
10 different criteria that go into building a quality  
11 remanufactured cartridge.

12 Many remanufacturers will simply collect empty --

13 MR. HOKANSON: Objection. Lack of personal  
14 knowledge. Speculation.

15 THE COURT: Well, set the foundation. He's talking  
16 about industry-wide standards, so set a foundation.

17 Q. Andrew, in your position at Lexmark do you familiarize  
18 yourself with the remanufacturing industry?

19 A. I do. I've been to many remanufacturing conferences,  
20 attended both in the U.S. and overseas. I'm quite familiar  
21 with the process used that remanufacturers use to build and  
22 sell remanufactured toner cartridges.

23 Q. Go ahead.

24 A. So a remanufacturer will collect an empty cartridge, they  
25 will clean the cartridge, they will replace the toner, they

1 will replace the microchip and then, again, sell that. We do  
2 see a wide variety of quality offered for sale. We do  
3 third-party testing of toner cartridges, so we will buy  
4 samples of remanufactured toner cartridges and send them to a  
5 third-party company for testing.

6 Some of these cartridges are what we would term or what  
7 the testing company refers to as DOA or Dead On Arrival.  
8 These cartridges would not work out of the box. Quite often,  
9 you know, these are cartridges where they open the box, they  
10 open the bag and there is toner leaking out of the cartridge.  
11 Seals have not been replaced or seals have worn, and the  
12 cartridges will leak toner.

13 Some of the remanufactured cartridges are quite good, but  
14 there is a large variation in the quality of remanufactured  
15 cartridges.

16 Q. Do remanufacturers typically alter the structure of the  
17 cartridge?

18 A. No.

19 Q. Because it wouldn't work?

20 A. It wouldn't work.

21 Q. Okay. You talked about some of the variations in quality  
22 among the third-party remanufactured cartridges. Why does  
23 Lexmark care? It's not you that remanufactured the cartridge.

24 A. That is true, we did not remanufacture the cartridge.

25 However, it is our printer. It's our printer customer. If a

1 customer has a quality issue with a cartridge and they are  
2 unable to determine what brand the cartridge is or where the  
3 cartridge came from, they are most likely to pick up the  
4 phone, call Lexmark and say, "I've got one of your printers.  
5 The cartridge leaked into my printer. My printer won't work.  
6 The cartridge damaged the fuser, and now my printer won't  
7 work."

8 And then at that point Lexmark will have to repair the  
9 printer, so we would bear the warranty cost for the printer  
10 repair.

11 If this is a repeated issue where the customer has many  
12 issues with the quality of the cartridges, when it comes time  
13 to replace that printer, you know, they may, you know, decide  
14 to look elsewhere. So there is a possible loss of goodwill in  
15 addition by the repeated failure of the cartridges where the  
16 customer doesn't know the original remanufacturer or  
17 manufacturer of that cartridge.

18 Q. In your position have you seen remanufactured cartridges  
19 that were first sold by Lexmark in other countries make their  
20 way into the U.S.?

21 A. Yes, I have.

22 Q. Is that a common practice?

23 A. It is, yes.

24 Q. And does Lexmark care about that?

25 A. We do care. Cartridges first sold outside the United

1           Mr. Meece in his opening referred to geographic  
2           designations. Could you describe for the Court Lexmark's  
3           geographic designations maybe before you get into this  
4           cartridge?

5           A. Okay. For printers launched by Lexmark post 2005, we  
6           introduced a regionalization program that allows us to  
7           separate the globe into various parts. But for marketing  
8           purposes, it also helps us enforce our grey market  
9           regionalization program.

10           So the chip on the cartridge provides the differentiation.  
11           The part number on the cartridge, the suffix for cartridges  
12           sold in North America with the letter A; if a cartridge is  
13           sold in Latin America, it would be a letter L; E for Europe,  
14           Middle East, Africa; and either P or R for Asian-Pacific  
15           market.

16                   MR. LOY: This is Exhibit A4. It's agreed, Your  
17           Honor.

18                   THE COURT: Okay. Is this the same as the slide  
19           presentation?

20                   MR. LOY: It's the same as the slide presentation.  
21           Mr. Gardner can tell you some of the more detailed  
22           information.

23                   THE COURT: Do we need to repeat all this?

24                   MR. HOKANSON: No.

25                   THE COURT: I mean, I got it, so I don't know --

1 A. The serial number has been removed, and the original  
2 Lexmark microchip has been replaced.

3 Q. While you're examining this, does Lexmark derive most of  
4 its profit from the printers or the cartridges?

5 A. From the cartridges.

6 Q. Okay.

7 A. This is box Exhibit 26. This is again for a Lexmark E321  
8 printer. This is not a Lexmark box.

9 This is cartridge Exhibit 27. This is the tape that had  
10 covered the original Lexmark label. As we can see, the  
11 original Lexmark label is still present. 12a7405 is the  
12 original Lexmark part number. This, again, is for a printer  
13 that was introduced before our regionalization program. The  
14 original Lexmark serial number has been removed. There is a  
15 third party or somebody else's serial number on the bottom of  
16 the cartridge, and the original Lexmark microchip has been  
17 replaced.

18 Q. Like the other cartridges, if you had either that  
19 microchip or the serial number could you determine where this  
20 was first sold?

21 A. Yes.

22 Q. And like the first cartridge for both this cartridge and  
23 the one previously that we looked at, do you have a sense of  
24 when they were manufactured by Lexmark?

25 A. If we had the serial number, we could tell exactly.

1 MR. MEECE: Yes.

2 THE COURT: Anything else, Lindsay?

3 MS. POTRAFKE: I don't think so.

4 MR. MEECE: Thank you.

5 THE COURT: Thanks, guys.

6 MR. KERN: Thank you, Your Honor.

7 MR. HOKANSON: Thank you, Your Honor.

8 COURTROOM DEPUTY: This court is now adjourned.

9  
10 (The proceedings concluded at 5:20 p.m.)  
11  
12  
13  
14

15 C E R T I F I C A T E  
16

17 I CERTIFY THAT THE FOREGOING IS A CORRECT TRANSCRIPT FROM  
18 THE RECORD OF PROCEEDINGS IN THE ABOVE-ENTITLED MATTER.  
19

20 S/MARYANN T. MAFFIA, RDR

21 Official Court Reporter  
22  
23  
24  
25

U 7218663

# THE UNITED STATES OF AMERICA

**TO ALL TO WHOM THESE PRESENTS SHALL COME:**

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 04, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: 5,337,032

ISSUE DATE: August 09, 1994

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



T. LAWRENCE  
Certifying Officer



US005337032A

**United States Patent** [19][11] **Patent Number:** **5,337,032****Baker et al.**[45] **Date of Patent:** **Aug. 9, 1994**[54] **REDUCED COMPONENT TONER CARTRIDGE**

[56]

**References Cited****U.S. PATENT DOCUMENTS**

[75] **Inventors:** Ronald W. Baker, Versailles; Robert L. Burdick, Nicholasville; Martin V. DiGirolamo, Lexington; Paul D. Horrall, Lexington; David L. Merrifield, Lexington; James J. Molloy, Lexington; Earl D. Ward, II, Lexington; Bernard L. Wilzbach, Lexington, all of Ky.

|           |        |                |           |
|-----------|--------|----------------|-----------|
| 5,012,289 | 4/1991 | Aldrich et al. | 355/260   |
| 5,085,171 | 2/1992 | Aulick et al.  | 118/653   |
| 5,086,728 | 2/1992 | Kinoshita      | 118/653   |
| 5,101,237 | 3/1992 | Molloy         | 355/245   |
| 5,183,964 | 2/1993 | Stelter et al. | 355/259 X |
| 5,220,129 | 6/1993 | Nishio et al.  | 355/259 X |
| 5,220,383 | 6/1993 | Enoki et al.   | 355/259 X |
| 5,239,344 | 8/1993 | Enoki et al.   | 355/259   |
| 5,245,391 | 9/1993 | Suzuki et al.  | 355/259 X |

*Primary Examiner*—Fred L. Braun*Attorney, Agent, or Firm*—John A. Brady

[73] **Assignee:** Lexmark International, Inc.,  
Greenwich, Conn.

[57]

**ABSTRACT**

[21] **Appl. No.:** 23,459

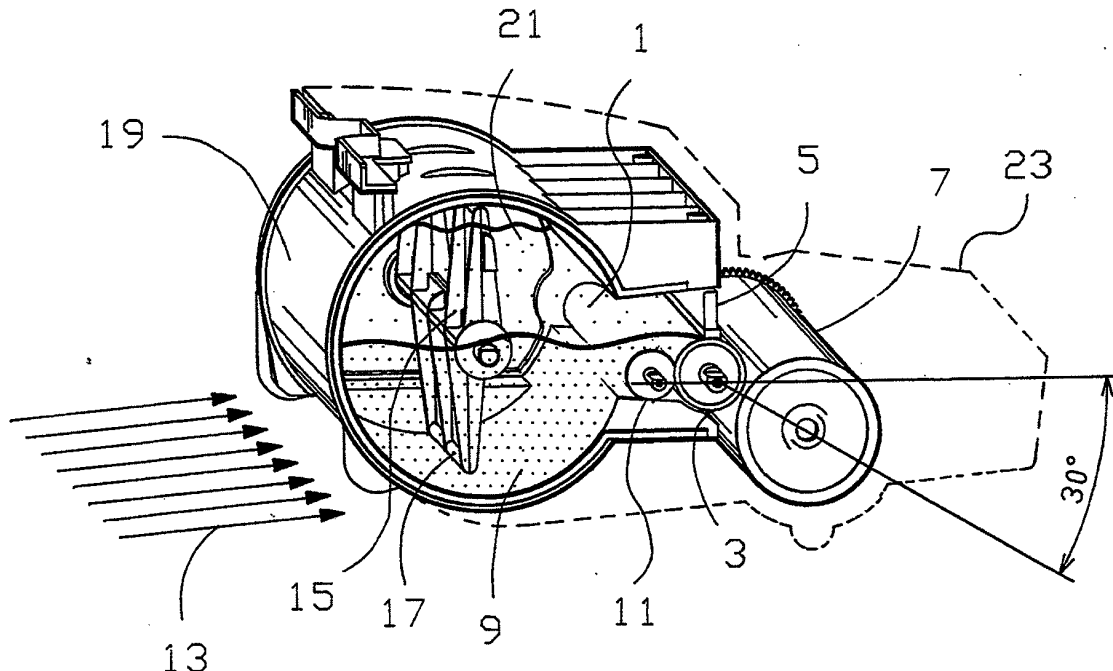
A toner cartridge having no toner pump with the toner adding roller (11) positioned horizontal to the developer roller (3), the toner chamber (9) located predominantly below the developer roller, the photoconductive drum located 120 degrees from the top of the developer roller, and the doctor blade (5) is located near the top. The cartridge has a minimal number of operational parts.

[22] **Filed:** Feb. 26, 1993

[51] **Int. Cl.<sup>5</sup>** ..... G03G 15/06; G03G 15/08;  
G03G 21/00

[52] **U.S. Cl.** ..... 355/260; 355/200

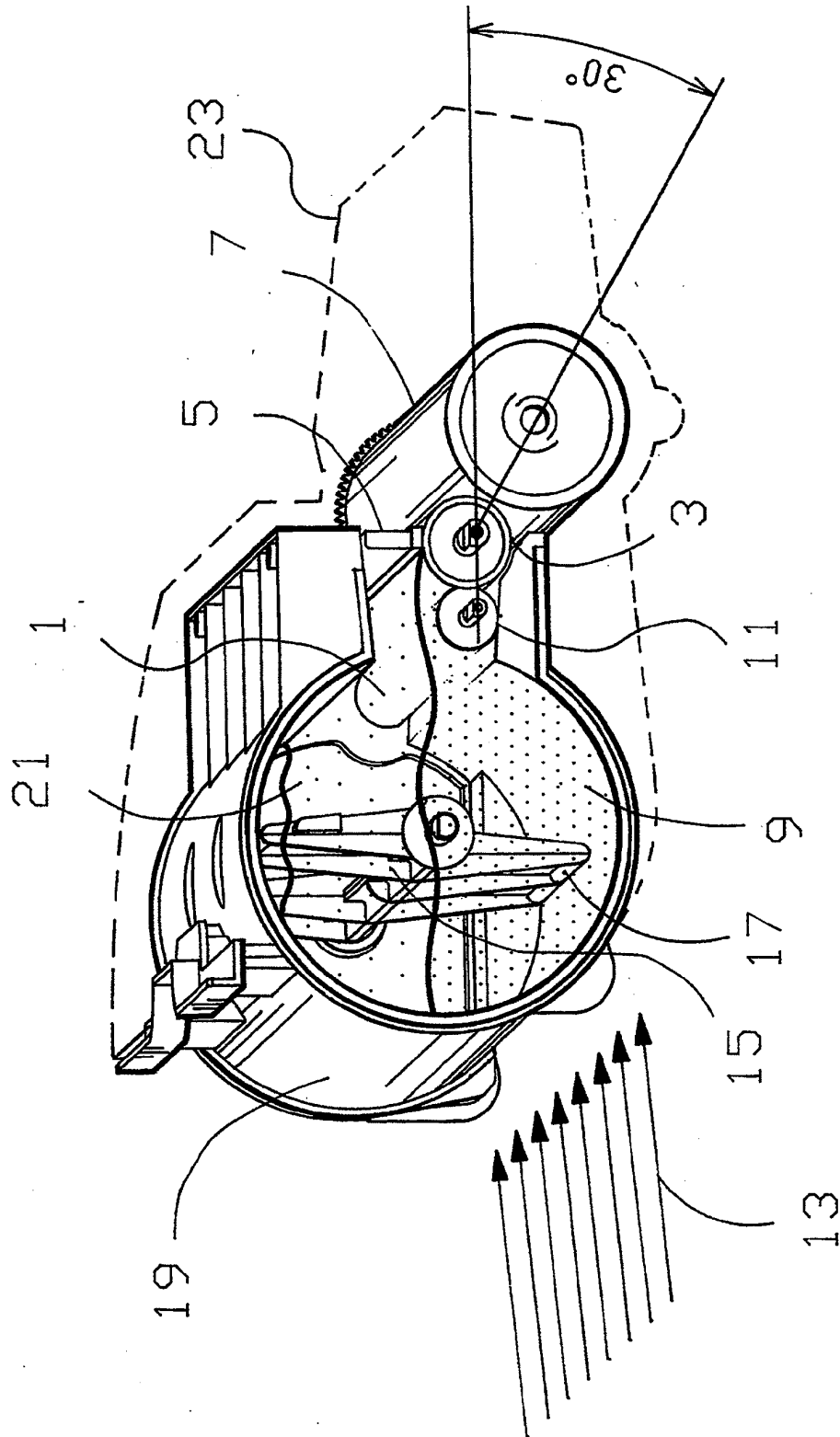
[58] **Field of Search** ..... 355/245, 259, 260, 200

**9 Claims, 1 Drawing Sheet**

U.S. Patent

Aug. 9, 1994

5,337,032



A4025

**REDUCED COMPONENT TONER CARTRIDGE****TECHNICAL FIELD**

This invention relates to electrophotographic development and, more particularly, relates to a toner cartridge having no toner pump and associated structure.

**BACKGROUND OF THE INVENTION**

The toner pump is described in U.S. Pat. No. 5,012,289 to Aldrich et al. It is a device which meters toner from a chamber above the developer station. The developer station employs a toner adding roller, which is at a predetermined electrical potential higher than that of the developer roller. The toner adding roller rotates in a bed of toner in contact with the developer roller and thereby applies toner onto the surface of the developer roller charged primarily to the same electrical sign as that of both the toner adding roller and the developer roller. The developer roller then rotates past a doctor blade which is charged to a potential higher than the developer roller and rejects much toner having the other potential (termed wrong sign toner). Such a system does not operate reliably under the pressures of a high column of toner which can reach the doctor blade-developer roller nip. The toner pump is employed to limit the toner head reaching the doctor blade-developer roller nip.

Elimination of the toner pump reduces manufacturing and material cost and unwanted pressure variations during operation caused by the operation of the pump, which have been remedied by a vent between both sides of the toner pump and by close tolerances. A two phase toner pump has also been developed to remedy this effect and is the subject of U.S. Pat. No. 5,101,237 to Molloy.

Elimination of the toner pump reduces variations in torques, since the other rollers are driven off the same power source as the toner pump. Reduction in such fluctuations can reduce jitter or, alternatively, reduces costs in powering the system adequately to avoid jitter.

U.S. Pat. No. 5,086,728 to Kinoshita shows a toner applying roller horizontal to a developer roller, but is not otherwise closely similar to this invention.

**DISCLOSURE OF THE INVENTION**

In the toner cartridge of this invention the primary toner chamber is located lower than the developer station. This chamber has a paddle which rotates constantly during operation, as was true with the cartridge with toner pump. In this cartridge, the paddle operation brings sufficient toner to the developing station even as the toner supply drops under the developing station. In the preferred embodiment a top half of the toner chamber exists to permit the paddle to smoothly rotate and to constrain airborne toner. However, the maximum filling of the toner chamber is to roughly the nip between the doctor blade and the developer roller.

**BRIEF DESCRIPTION OF THE DRAWING**

The details of this invention will be described in connection with the accompanying drawing in which the figure is an illustrative, side-perspective, cross sectioned view of the preferred cartridge in accordance with this invention.

**BEST MODE FOR CARRYING OUT THE INVENTION**

As seen in the drawing, the level of dry, powder toner 1 is not substantially above the nip of the developer roller 3 and the doctor blade 5. Doctor blade 5 contacts developer roller 3 substantially at the top of roller 3. In the drawing the loading of toner 1 is the maximum permitted in normal operation, and, of course, during use the amount of toner 1 will diminish. Developer roller 3 contacts photoconductive drum 7 at an angle of 30 degrees from the horizontal, which is 120 degrees from the location of contact of doctor blade 5 with roller 3. Since the toner chamber 9 occupies an area predominantly below roller 3, space is conserved by locating photoconductive drum 7 also predominantly below roller 3 (the foregoing cartridge with toner pump had a 13 degree angle).

The toner adder roller 11 is located generally horizontal with the developer roller 3 (i.e., with its nip control at 90 degrees from the top of roller 3). This position blocks excess toner from the chamber 9, and is important to reliable operation. With toner adder roller 11 physically between developer roller 3 and chamber 9, chamber 9 can extend downward more than twice the diameter of toner adder roller 11 as shown. Photoconductive drum 7 is located on the side of developer roller 3 opposite the location of toner adder roller 11. The bottom level of chamber 9 is determined by the toner volume requirements. The paper path 13 must be lowered to clear chamber 9.

During operation, paddle 15 continually moves toner in chamber 9 by blades 17 at the outer periphery of chamber 9. The developer unit housing 19 defines chamber 9 and a corresponding upper chamber 21, to form a closed chamber of chamber 9 and chamber 21 of circular configuration in which paddle 15 turns freely. The upper chamber 21 is never filled with toner 1 and exists to capture flying toner. The lack of toner in this region is to prevent excessive toner pressure.

Operation is inherent and characterized by a minimal number of operational parts in the cartridge. Paddle 15 rotates during all operation in a simple circle, and is therefore a minimal source of torque fluctuations. Toner adder roller 11 and developer roller 3 are electrically charged and rotate in the manner of the previous cartridge having a toner pump. Doctor blade 5 is preferably the low-cost, compliant doctor blade described in U.S. Pat. No. 5,085,171 to Aulick et al. Doctor blade 5 is electrically charged but not rotated or otherwise moved directly.

It will be understood that the elements described exist across the width of the cartridge, as shown in perspective in the drawing. It will also be understood that the photoconductive drum 7 is a part of the cartridge, the elements being unified by an outer housing 23, shown in phantom outline, as is now conventional. Toner is essentially the same as that in the cartridge with toner pump now widely distributed by the assignee of this invention for the IBM LaserPrinters 4019 and 4029, and as summarized in the foregoing U.S. Pat. No. 5,012,289.

What is claimed is:

1. An electrophotographic imaging toner cartridge comprising a developer roller, a doctor blade in contact with said developer roller near the top of said developer roller, a toner applying roller in contact with said developer roller and located on substantially the same horizontal plane as said developer roller, a chamber for

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electrophotographic toner positioned predominantly below said developer roller and on the side of said toner applying roller away from said developer roller, said chamber extending downward from the top of said toner applying roller more than twice the diameter of said toner applying roller.

2. The toner cartridge as in claim 1 also comprising a photoconductive roller in contact with said developer roller, said photoconductive roller being positioned substantially below said developer roller.

3. The toner cartridge as in claim 2 containing dry toner in an amount to fill said chamber up to about the level of the contact of said doctor blade and said developer roller.

4. The toner cartridge as in claim 2 containing dry toner in an amount less than an amount to fill said chamber up to about the level of the contact of said doctor blade and said developer roller.

5. The toner cartridge as in claim 1 containing dry toner in an amount to fill said chamber up to about the level of contact of said doctor blade and said developer roller.

6. The toner cartridge as in claim 1 containing dry toner in an amount less than an amount to fill said chamber up to about the level of the contact of said doctor blade and said developer roller.

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7. An electrophotographic imaging toner cartridge comprising a developer roller, a doctor blade in contact with said developer roller near the top of said developer roller, a toner applying roller in contact with said developer roller, the location of said contact being 90 degrees from the location of said contact of said doctor blade, a photoconductive roller in nip relationship with said developer roller, the location of said nip relationship being substantially 120 degrees from the location of said contact of said doctor blade on the side of said developer roller opposite the location of said toner applying roller, and a chamber for electrophotographic toner positioned on the side of said toner applying roller opposite said developer roller and having a predominate portion below said developer roller said chamber extending downward from the top of said toner applying roller more than twice the diameter of said toner applying roller.

8. The toner cartridge as in claim 7 contained dry toner in an amount to fill said chamber up to about the level of contact of said doctor blade and said developer roller.

9. The toner cartridge as in claim 7 containing dry toner in an amount less than an amount to fill said chamber up to about the level of the contact of said doctor blade and said developer roller.

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# THE UNITED STATES OF AMERICA

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January 04, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: 5,634,169

ISSUE DATE: May 27, 1997

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



T. LAWRENCE  
Certifying Officer







US005634169A

**United States Patent** [19]

Barry et al.

[11] **Patent Number:** 5,634,169[45] **Date of Patent:** May 27, 1997[54] **MULTIPLE FUNCTION ENCODER WHEEL FOR CARTRIDGES UTILIZED IN AN ELECTROPHOTOGRAPHIC OUTPUT DEVICE**

[75] **Inventors:** Raymond J. Barry, Lexington; Steven A. Curry, Nicholasville; Benjamin K. Newman; Gregory L. Ream, both of Lexington; Earl D. Ward, II, Richmond; Phillip B. Wright, Lexington, all of Ky.

[73] **Assignee:** Lexmark International, Inc., Lexington, Ky.

[21] **Appl. No.:** 602,648[22] **Filed:** Feb. 16, 1996[51] **Int. Cl.<sup>6</sup>** ..... G03G 15/08; G03G 15/00[52] **U.S. Cl.** ..... 399/12; 399/27; 235/461

[58] **Field of Search** ..... 355/260, 200, 355/206, 208, 203; 222/DIG. 1, 160; 414/411; 235/461; 340/615, 612, 603-617; 73/862.328, 862.329, 862.424, 862.425, 862.426

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| 4,711,561 | 12/1987 | Tsuruoka         | 355/3 R   |
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| 5,075,724 | 12/1991 | Wada et al.      | 355/203   |
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| 5,115,275 | 5/1992  | Suzuki           | 355/245   |
| 5,184,181 | 2/1993  | Kurando et al.   | 355/260   |
| 5,194,896 | 3/1993  | Buch et al.      | 355/212   |
| 5,208,631 | 5/1993  | Jacobs et al.    | 355/204   |

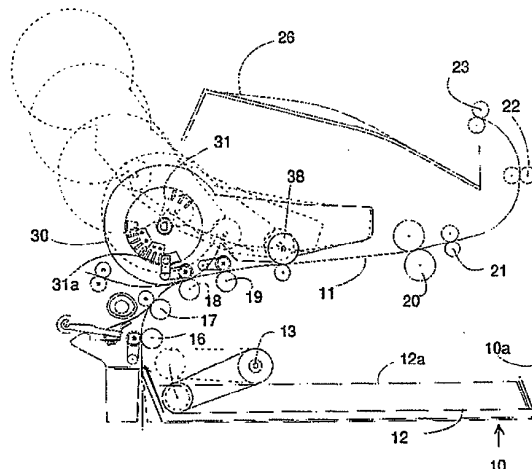
|           |         |                    |           |
|-----------|---------|--------------------|-----------|
| 5,216,462 | 6/1993  | Nakajima et al.    | 355/203   |
| 5,241,525 | 8/1993  | Taylor             | 369/70    |
| 5,257,077 | 10/1993 | Peters, Jr. et al. | 355/260   |
| 5,287,151 | 2/1994  | Sugiyama           | 355/260   |
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62-86382 4/1987 Japan.

*Primary Examiner*—Joan H. Pendegrass*Assistant Examiner*—Quana Grainger*Attorney, Agent, or Firm*—Ronald K. Aust[57] **ABSTRACT**

Disclosed is a cartridge having an encoder wheel thereon for encoding EP supply cartridge characteristic information for an electrophotographic machine, the cartridge comprising, a sump for carrying an initial amount of toner. A shaft is mounted for rotation in said sump, and an agitator or paddle is mounted thereon in such a manner that when the shaft rotates, the paddle rotates into, through and out of engagement with toner carried by the sump. A single encoder wheel is mounted on the shaft, external of the sump, the encoder wheel positioned for proximate mating coaction with a coded wheel reader when the cartridge is mounted in position in the electrophotographic machine. A drive means, and a variable torque flexible coupling connects the drive means to the shaft to effect rotation thereof. The encoder wheel is configured for indicating, in conjunction with said coded wheel reader, a component of resistance to paddle movement through the portion of said sump having toner therein to give an indication of the amount of toner remaining in said sump. Other portions of the wheel, in a portion thereof which confronts the reader during a substantially constant velocity of rotation thereof, carries additional characteristic information of the cartridge to permit proper operation of the machine as well as increased efficiency of operation thereof.

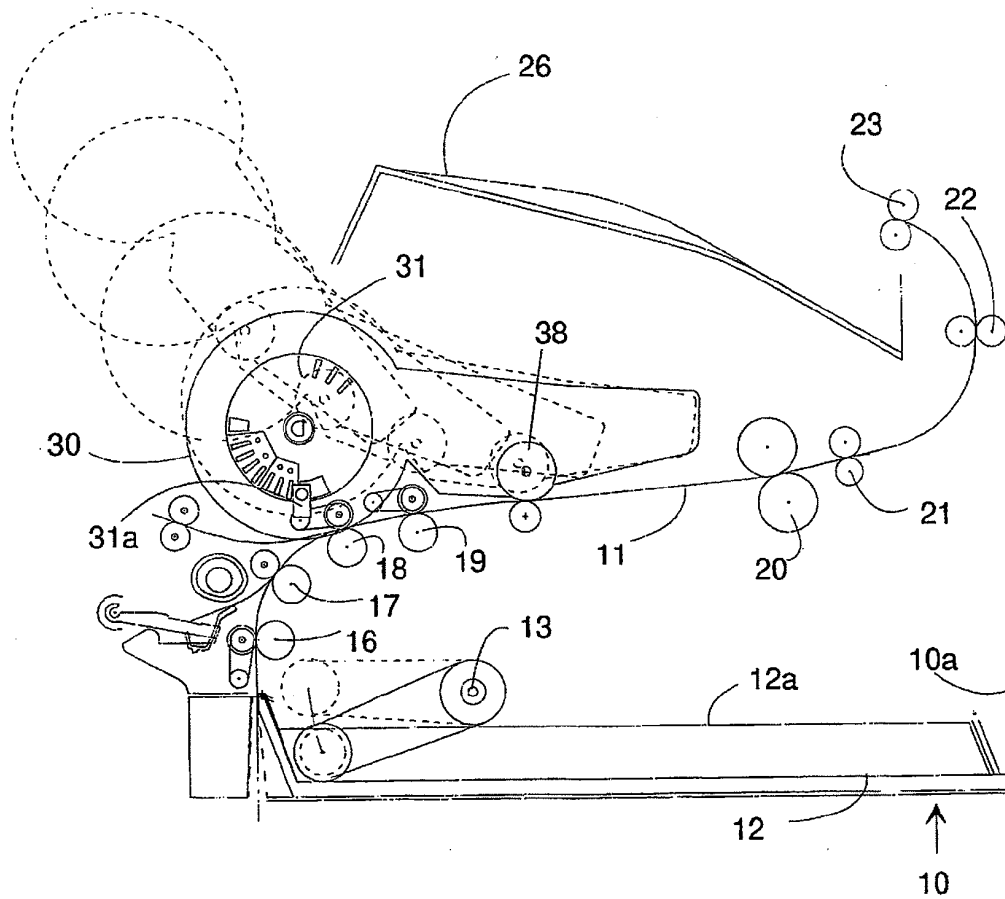
**42 Claims, 10 Drawing Sheets**

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**Fig. 1**



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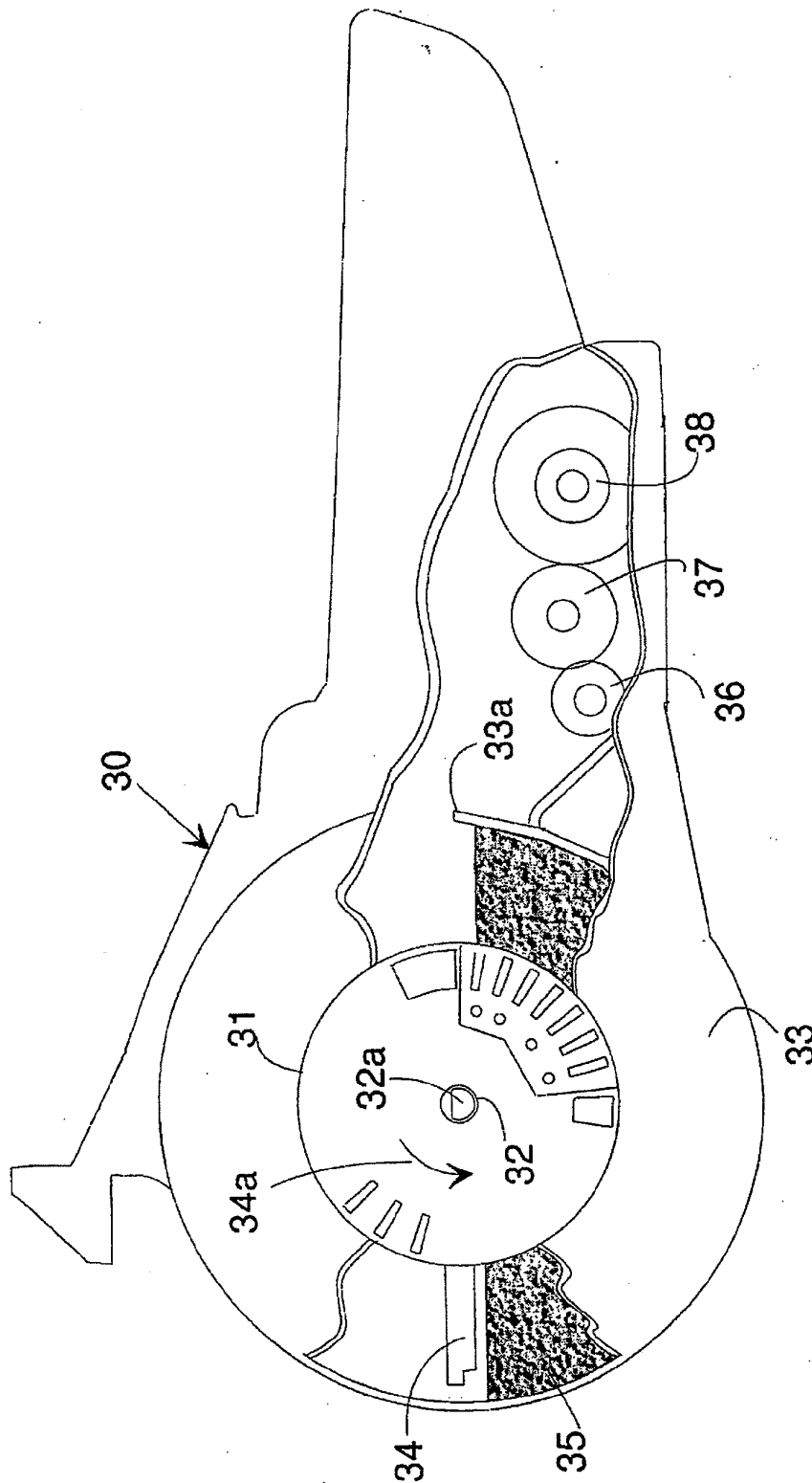


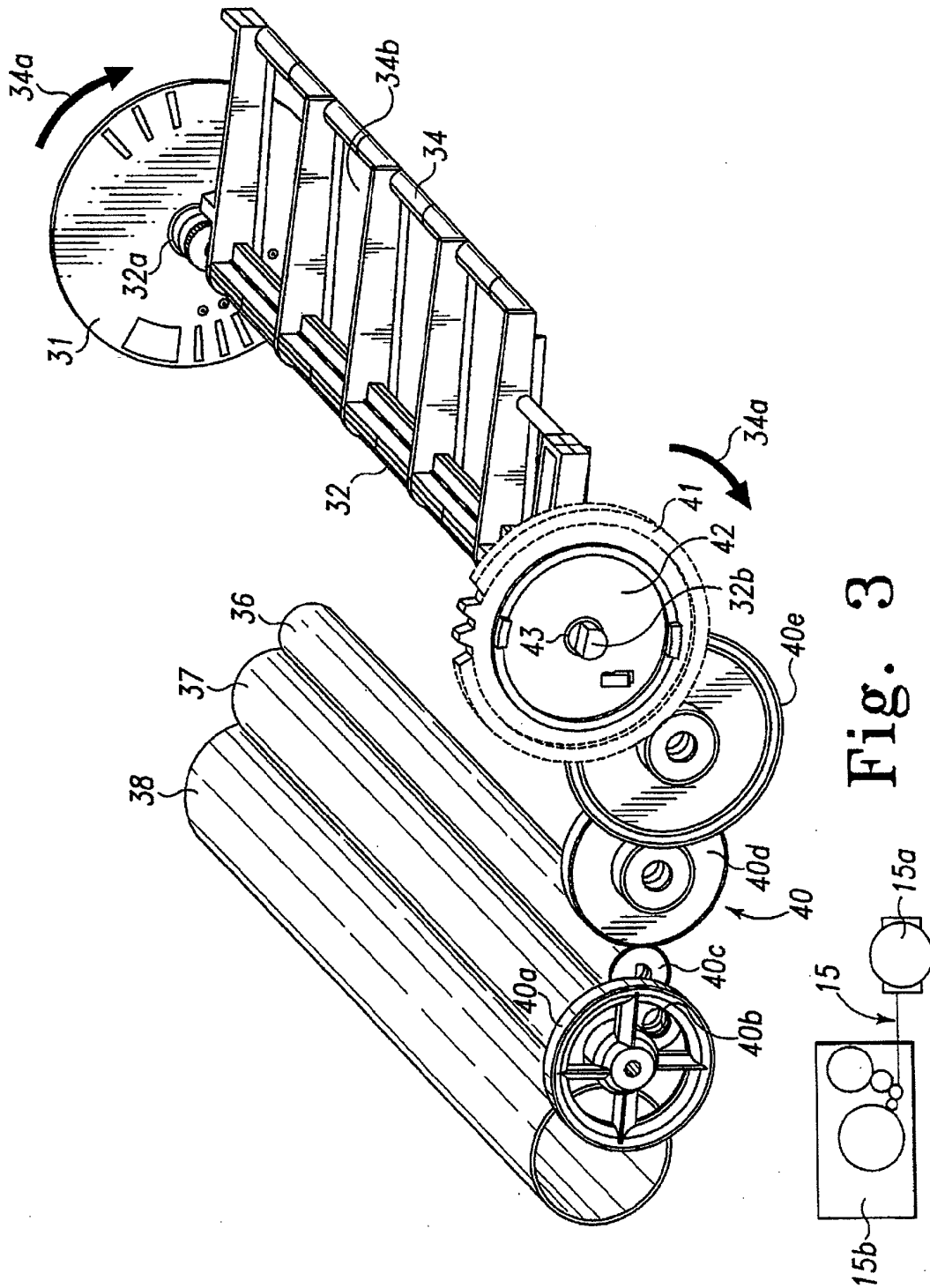
Fig. 2

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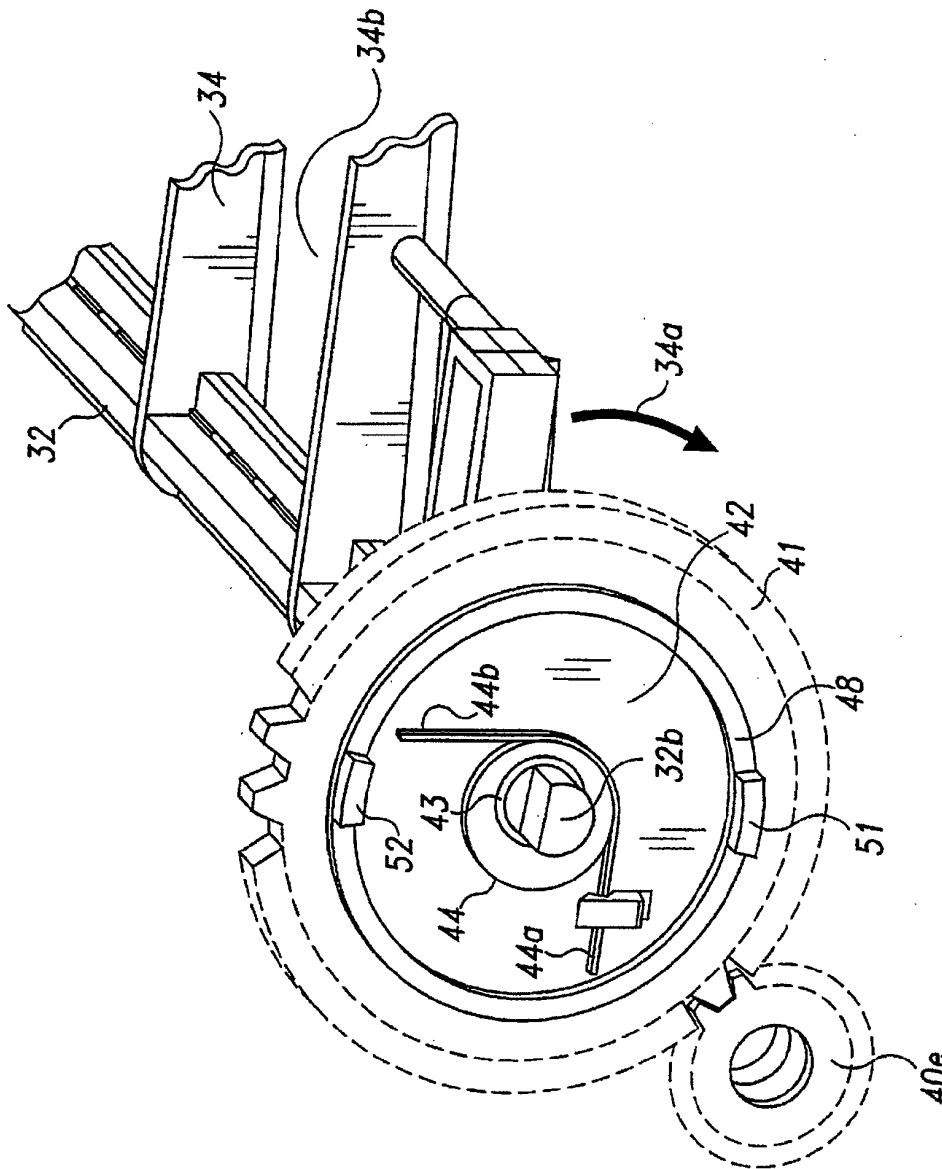


Fig. 4

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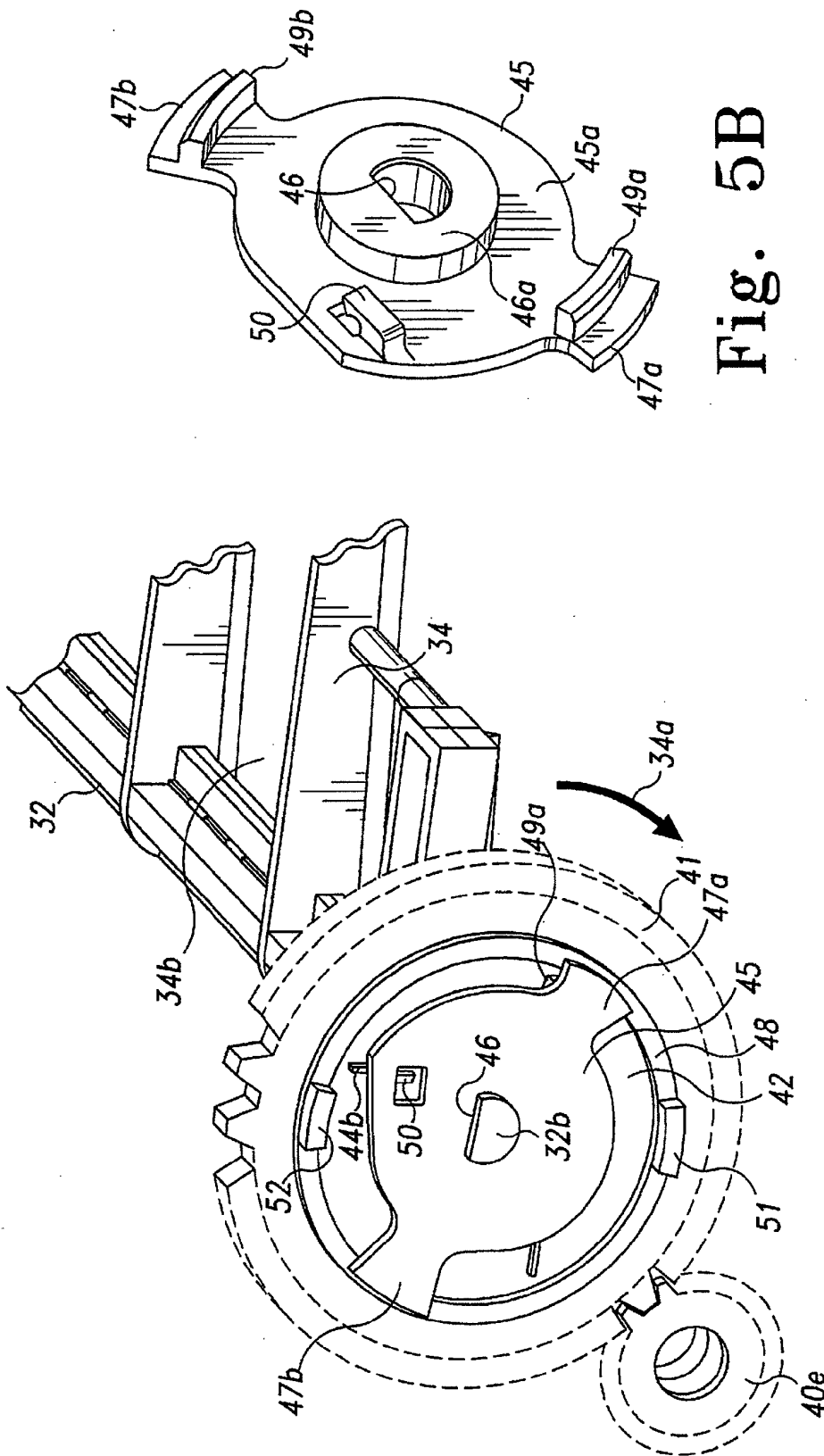


Fig. 5B

Fig. 5A

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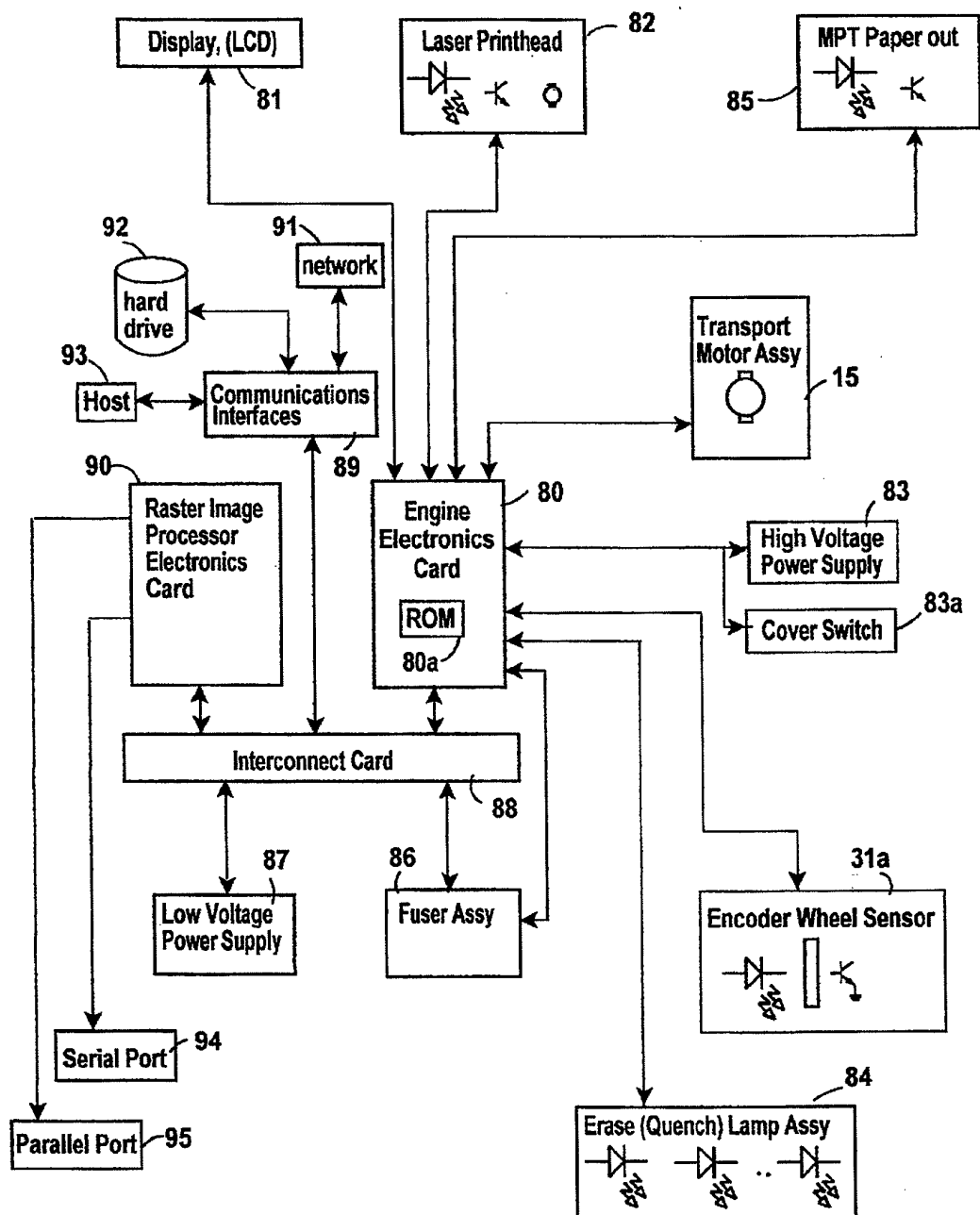


Fig. 6

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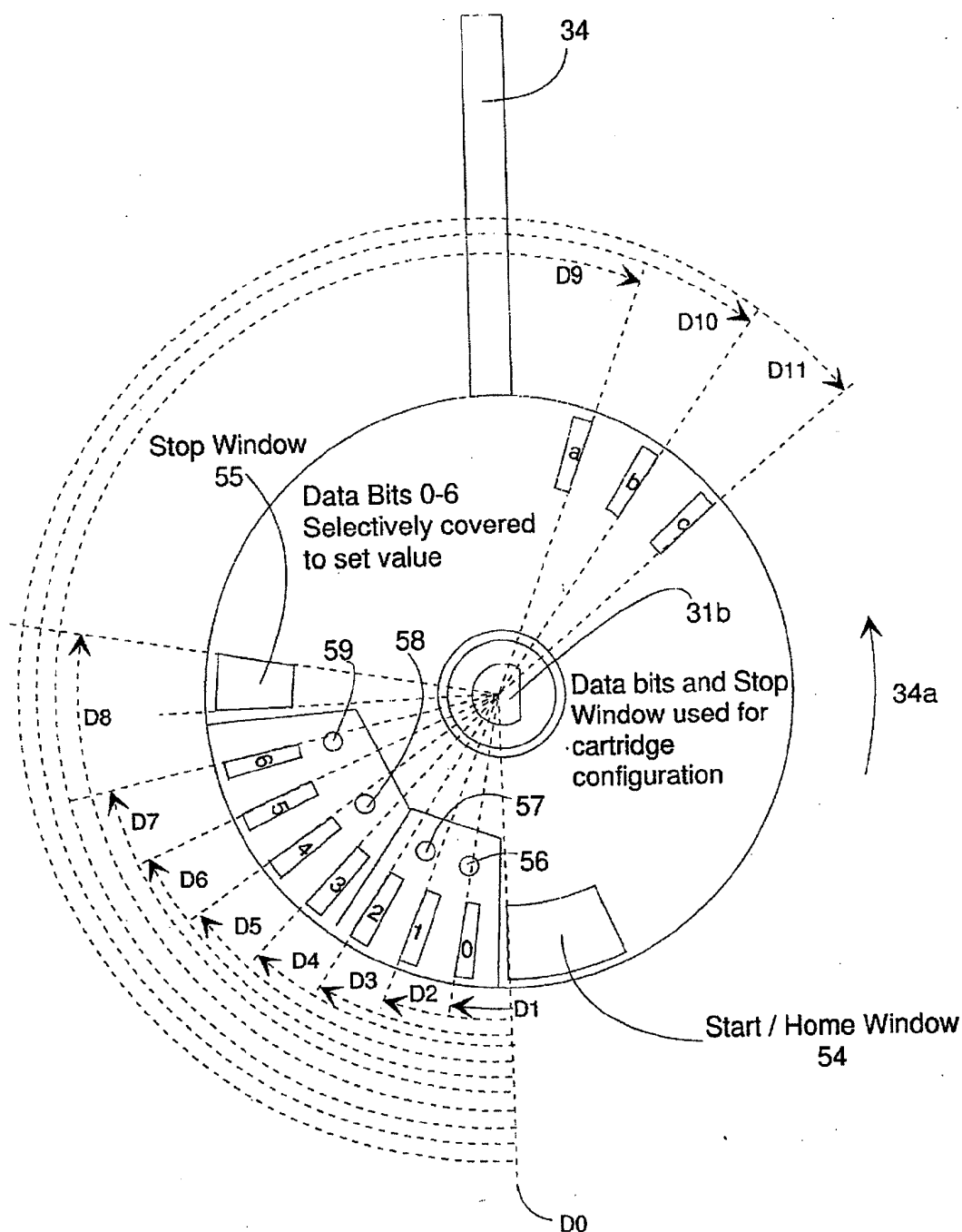


Fig. 7

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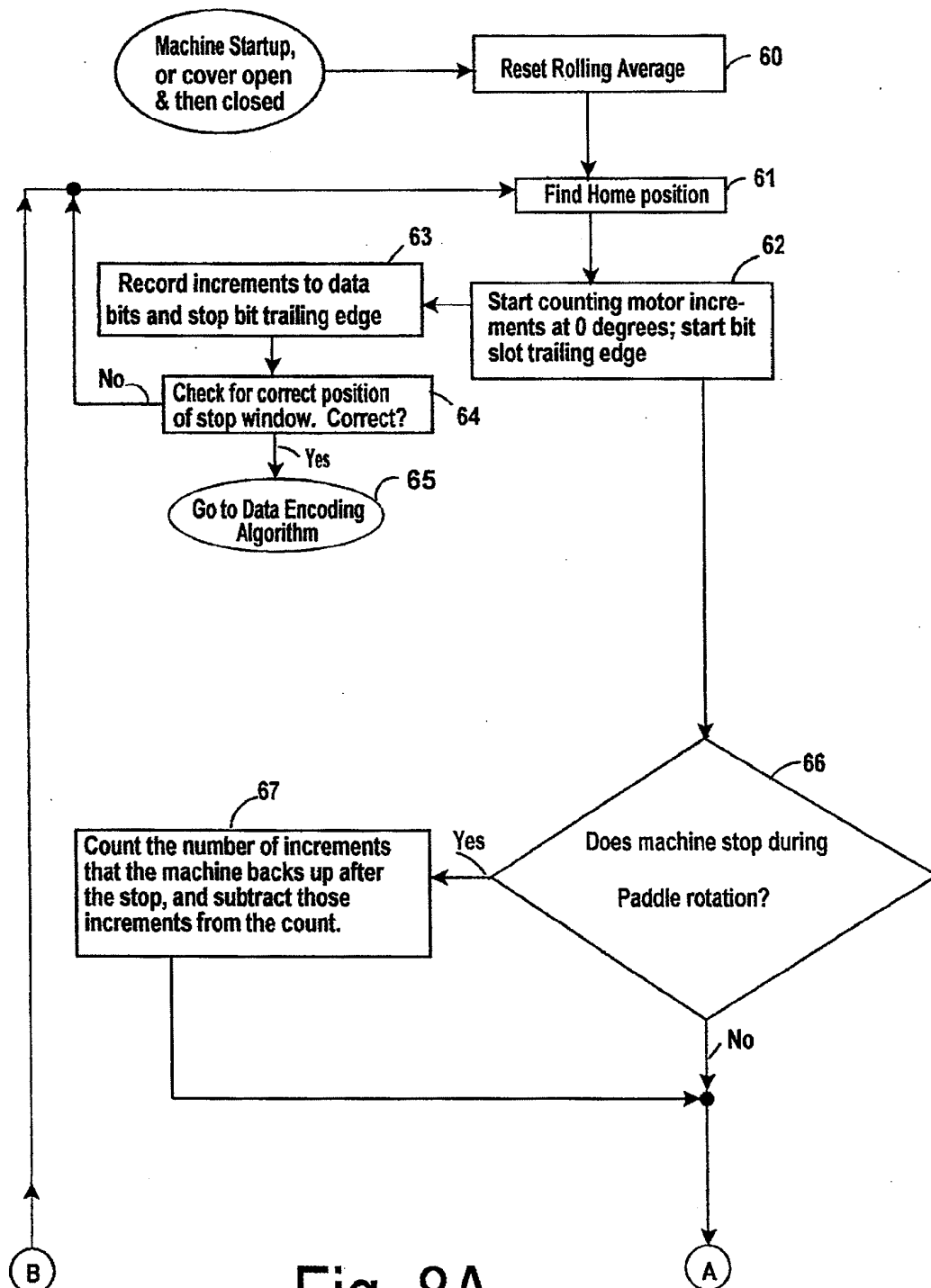


Fig. 8A



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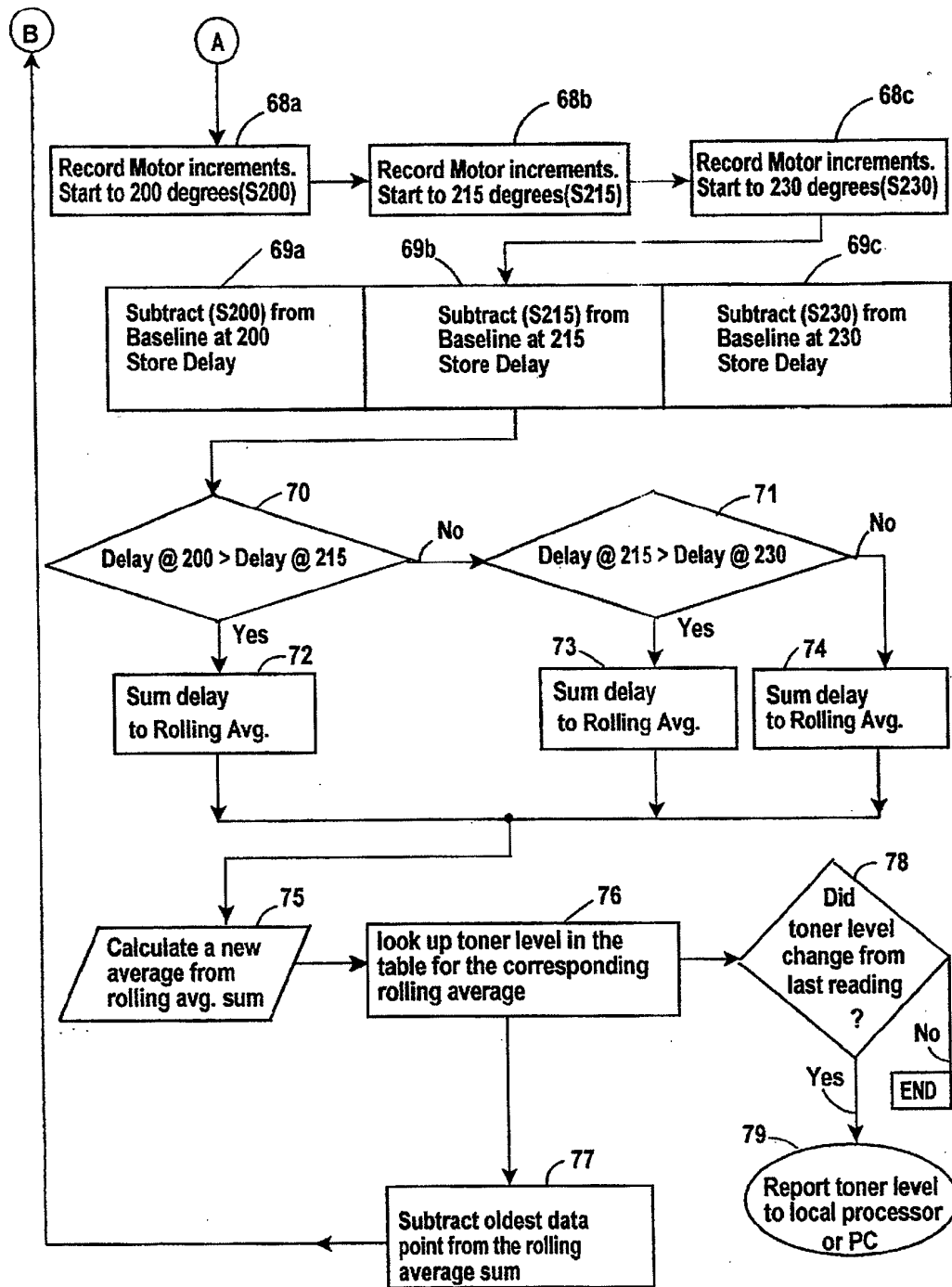


Fig. 8B

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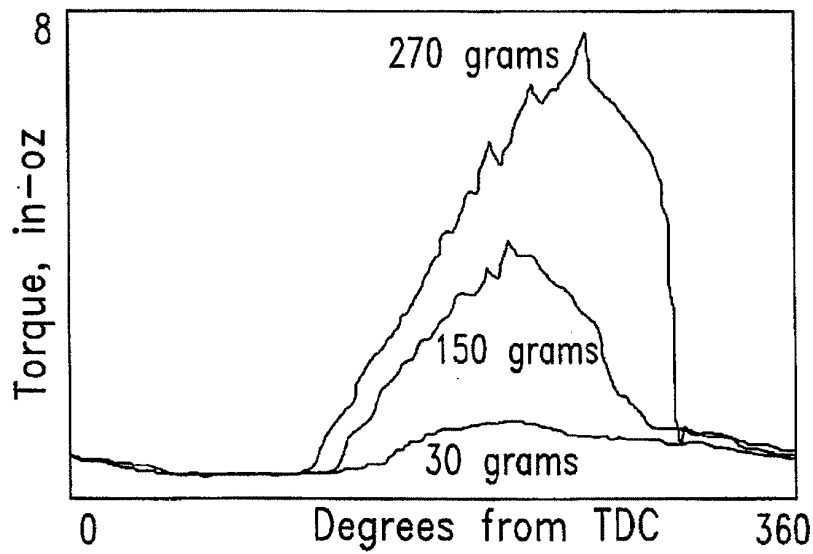


Fig. 9

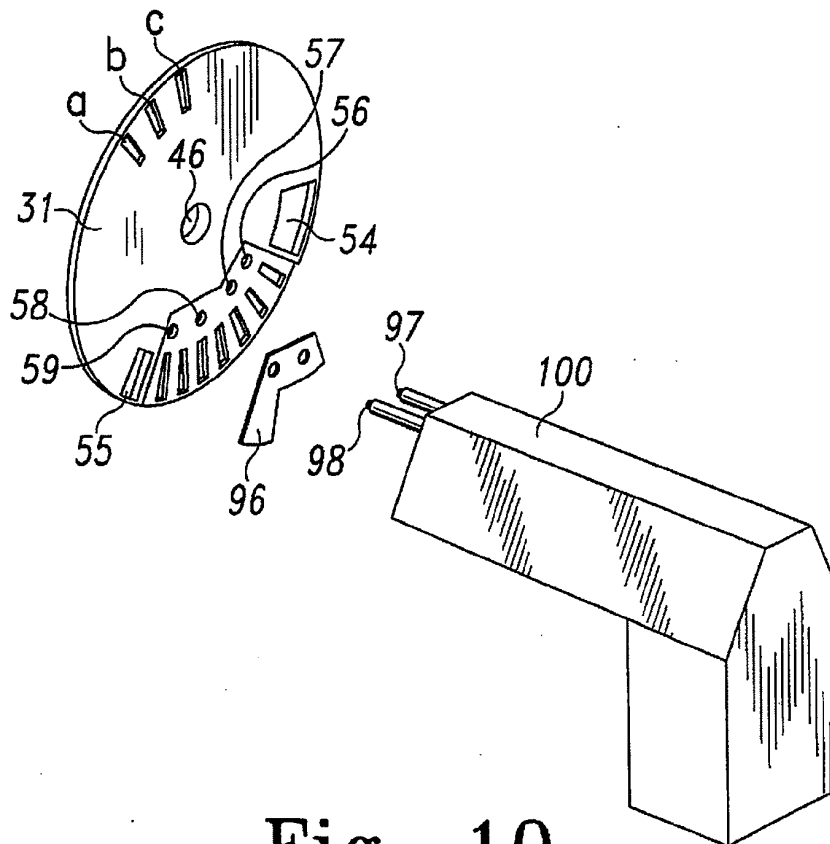


Fig. 10

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# **MULTIPLE FUNCTION ENCODER WHEEL FOR CARTRIDGES UTILIZED IN AN ELECTROPHOTOGRAPHIC OUTPUT DEVICE**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

The present invention relates to Electrophotographic (EP) machines and more particularly relates to methods and apparatus associated with replaceable supply cartridges for such machines wherein information concerning the cartridge is provided to the machine for not only increasing the efficiency of operation thereof but to permit correct operation of the machine.

### **2. Description of Related Art**

Many Electrophotographic output device (e.g., laser printers, copiers, fax machines etc.) manufacturers such as Lexmark International, Inc., have traditionally required information about the EP cartridge to be available to the output device such that the control of the machine can be altered to yield the best print quality and longest cartridge life.

The art is replete with devices or entry methods to inform the EP machine about specific EP cartridge characteristics. For example, in U.S. Pat. No. 5,208,631 issued on May 4, 1993, a technique to identify colorimetric properties of toner contained within a cartridge in a reproduction machine by imbedding in a PROM within the cartridge specific coordinates of a color coordinate system for mapping color data, is disclosed.

In other prior art, for example U.S. Pat. No. 5,289,242 issued on Feb. 22, 1994, there is disclosed a method and system for indicating the type of toner print cartridge which has been loaded into an EP printer. Essentially, this comprises a conductive strip mounted on the cartridge for mating with contacts in the machine when the lid or cover is dosed. The sensor is a two position switch which tells the user the type of print cartridge which has been loaded into the printer. While this method is effective, the amount of information that can be provided to the machine is limited.

In still other prior art, such as in U.S. Pat. No. 5,365,312 issued on Nov. 15, 1994, a memory chip containing information about the current fill status or other status data is retained. The depleted status of print medium is supplied by counting consumption empirically. The average of how much toner is required for toning a charge image is multiplied by the number of revolutions of the charge image carrier or by the degree of inking of the characters via an optical sensor. In either method, the count is less than accurate and depends upon average ink coverage on the page, or alternatively, the character density which can change dramatically due to font selection. Therefore at best, the consumption count lacks accuracy.

The literature suggests several methods for detecting toner level in a laser printer. Most of these methods detect a low toner condition or whether toner is above or below a fixed level. Few methods or apparatus effectively measure the amount of unused toner remaining. As an example, Lexmark® printers currently employ an optical technique to detect a low toner condition. This method attempts to pass a beam of light through a section of the toner reservoir onto a photo sensor. Toner blocks the beam until its level drops below a preset height.

Another common method measures the effect of toner on a rotating agitator or toner paddle which stirs and moves the

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toner over a sill to present it to a toner adder roll, then developer roll and ultimately the PC Drum. The paddle's axis of rotation is horizontal. As it proceeds through its full 360 degree rotation the paddle enters and exits the toner supply. Between the point where the paddle contacts the toner surface and the point where it exits the toner, the toner resists the motion of the paddle and produces a torque load on the paddle shaft. Low toner is detected by either 1) detecting if the torque load caused by the presence of toner is below a given threshold at a fixed paddle location or 2) detecting if the surface of the toner is below a fixed height.

In either method there is a driving member supplying drive torque to a driven member (the paddle) which experiences a load torque when contacting the toner. Some degree of freedom exists for these two members to rotate independently of each other in a carefully defined manner. For the first method 1) above, with no load applied to the paddle, both members rotate together. However, when loaded the paddle lags the driving member by an angular distance that increases with increasing load. In the second method 2), the unloaded paddle leads the rotation of the driving member, under the force of a spring or gravity. When loaded (i.e., the paddle contacts the surface of the toner), the driving and driven members come back into alignment and rotate together. By measuring the relative rotational displacement of the driving and driven members (a.k.a. phase difference) at an appropriate place in the paddle's rotation, the presence of toner can be sensed.

In the prior art, this relative displacement is sensed by measuring the phase difference of two disks. The first disk is rigidly attached to a shaft that provides the driving torque for the paddle. The second disk is rigidly attached to the shaft of the paddle and in proximity to the first disk. Usually both disks have matching notches or slots in them. The alignment of the slots or notches, that is how much they overlap, indicates the phase relationship of the disks and therefore the phase of the driving and driven members.

Various art showing the above methods and variations are set forth below.

In U.S. Pat. No. 4,003,258, issued on Jan. 18, 1977 to Ricoh Co., is disclosed the use of two disks to measure toner paddle location relative to the paddle drive shaft. When the paddle reaches the top of its rotation the coupling between paddle and drive shaft allows the paddle to free fall under the force of gravity until it comes to rest on the toner surface or at the bottom of its rotation. Toner low is detected if the angle through which the paddle falls is greater than a fixed amount (close to 180 degrees). A spring connects the two disks, but the spring is not used for toner detection. It is used to fling toner from the toner reservoir to the developer.

In U.S. Pat. No. 5,216,462, issued to Oki Electric Co., Jun. 1, 1993, is described a system where a spring connects two disks so that the phase separation of the disks indicates torque load on the paddle. An instability is noted in this type of system. It further describes a system similar to the Patent above where the paddle free falls from its top dead position to the surface of the toner. The position of the paddle is sensed through magnetic coupling to a lever outside of the toner reservoir. This lever activates an optical switch when the paddle is near the bottom of its rotation. A low toner indication results when the time taken for the paddle to fall from top dead center to the bottom of the reservoir, as sensed by the optical switch, is less than a given value.

In U.S. Pat. No. 4,592,642, issued on Jun. 3, 1986 to Minolta Camera Co., is described a system that does not use the paddle directly to measure toner, but instead uses the

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motion of the paddle to lift a "float" above the surface of the toner and drop it back down on top of the toner surface. A switch is activated by the "float" when in the low toner position. If the "float" spends a substantial amount of time in the low toner position the device signals low toner. Although the patent implies that the amount of toner in the reservoir can be measured, the description indicates that it behaves in a very non-linear, almost binary way to merely detect a toner low state.

U.S. Pat. No. 4,989,754, issued on Feb. 5, 1991 to Xerox Corp., differs from the others in that there is no internal paddle to agitate or deliver toner. Instead the whole toner reservoir rotates about a horizontal axis. As the toner inside rotates with the reservoir it drags a rotatable lever along with it. When the toner level becomes low, the lever, no longer displaced from its home position by the movement of the toner, returns to its home position under the force of gravity. From this position the lever activates a switch to indicate low toner.

In still another U.S. Pat. No. 4,711,561, issued on Dec. 8, 1987 to Rank Xerox Limited, this patent describes a means of detecting when a waste toner tank is full. It employs a float that gets pushed upward by waste toner fed into the tank from the bottom. The float activates a switch when it reaches the top of the tank.

U.S. Pat. No. 5,036,383, issued on Jul. 30, 1991 to Fujitsu Limited, describes the use of a commercially available vibration sensor to detect the presence of toner at a fixed level. The patent describes a simple timing method for ignoring the effect of the sensor cleaning mechanism on the sensor output.

U.S. Pat. No. 5,349,377, issued on Sep. 20, 1994 to Xerox Corp. discloses an algorithm for calculating toner usage and hence amount of toner remaining in the reservoir by counting black pixels and weighting them for toner usage based on pixels per unit area in the pixel's neighborhood. This is unlike the inventive method and apparatus disclosed hereinafter.

### SUMMARY OF THE INVENTION

In view of the above, it is a principal object of the present invention to provide a simple yet effective method and apparatus for transmitting to a machine of the type utilizing toner, information concerning the contents of the cartridge, but also combining with such information continuing data relating to the amount of toner left in the cartridge during machine operation.

Another object of the present invention is to provide suitable software to automatically determine, upon machine power-on-reset (POR) or other resumption of functions, whether conditions have changed or altered since the last period of running of the machine, and to alter the machine running conditions in view of those determinations or findings.

Still another object of the present invention is to provide a simplified, but effective method and means for changing the initial information concerning the cartridge, but one that is accurate enough and simple enough to allow for end of manufacturing line or field alterations.

Yet another object of the present invention is to provide, in a single encoder wheel associated with the supply EP cartridge, information which may include, but is not limited to, PC drum type; "Vendor ID" which inhibits unauthorized cartridges from being employed in the machine; indicates original cartridge capacity; whether the toner is MICR (magnetic for bank checks etc.) or non-MICR toner and may include detection of the level of the toner in the cartridge sump.

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To this end, the present invention encompasses a method and apparatus for providing information to a machine about the characteristics of an EP cartridge, which alter the operation of the machine in which it is employed. The invention uses an encoder wheel mounted to the shaft of a portion of the machine associated with the replaceable supply cartridge which, through at least a portion of its rotation, rotates at a substantially constant velocity. The wheel contains encoded information that can be read by conventional sensing methods and means are provided to create a serial bit stream which is then decoded to obtain information about the cartridge. Another portion of the wheel provides on a continuing basis, variable data on how much toner is left in the cartridge.

With regard to the latter function, the invention disclosed herein improves upon the prior art by using only one disk rigidly attached to the paddle shaft, along with knowledge of the cyclical nature of the torque load due to the resistance encountered by the paddle when it moves through the toner. In this manner, the lag between the driven and driving members is a function of this resistance and the amount of toner in the toner sump. This invention also improves upon prior art by distinguishing between several different levels of toner in the sump, not just one. This capability arises from being able to measure the magnitude of the torque load and from the ability to measure the torque in more than one circumferential agitator or paddle location.

Other objects and a more complete understanding of the invention may be had by referring to the following description taken in conjunction with the accompanying drawings in which:

### BRIEF DESCRIPTION OF THE DRAWING(S)

FIG. 1 is a schematic side elevational view illustrating the paper path in a typical electrophotographic machine, in the illustrated instance a printer, and showing a replacement supply EP cartridge, constructed in accordance with the present invention, and the manner of insertion thereof into the machine;

FIG. 2 is a fragmentary, enlarged, simplified, side elevational view of the cartridge illustrated in FIG. 1, and removed from the machine of FIG. 1;

FIG. 3 is a fragmentary perspective view of the interior driven parts of the EP cartridge illustrated in FIGS. 1 and 2, including the encoder wheel and its relative position with regard to the drive mechanism for the cartridge interior driven parts;

FIG. 4 is an enlarged fragmentary perspective view of the agitator/paddle drive for the toner sump, and illustrating a portion of the torque sensitive coupling between the drive gear and the driven shaft for the agitator/paddle;

FIG. 5A is a fragmentary view similar to FIG. 4, except illustrating another portion of the torque sensitive coupling for coupling the driven shaft for the agitator/paddle, through the coupling to the drive gear, and FIG. 5B depicts the reverse side of one-half of the torque sensitive coupling, and that portion which connects to the agitator/paddle shaft;

FIG. 6 is a simplified electrical diagram for the machine of FIG. 1, and illustrating the principal parts of the electrical circuit;

FIG. 7 is an enlarged side elevational view of the encoder wheel employed in accordance with the present invention, and viewed from the same side as shown in FIG. 2, and from the opposite side as shown in FIG. 3;

FIG. 8A is a first portion of a flow chart illustrating the code necessary for machine start up, and the reading of information coded on the encoder wheel;



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FIG. 8B is a second portion of the flow chart of FIG. 8A illustrating the measurement of toner level in the toner sump;

FIG. 9 is a graphical display of the torque curves for three different toner levels within the sump, and at various positions of the toner paddle relative to top dead center or the home position of the encoder wheel; and

FIG. 10 is a perspective view of an encoder wheel with novel apparatus for blocking off selected slots in the encoder wheel for coding the wheel with EP cartridge information.

#### DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT(S)

Turning now to the drawings, and particularly FIG. 1 thereof, a laser printer 10 constructed in accordance with the present invention, is illustrated therein. FIG. 1 shows a schematic side elevational view of the printer 10, illustrating the print receiving media path 11 and including a replacement supply electrophotographic (EP) cartridge 30, constructed in accordance with the present invention. As illustrated, the machine 10 includes a casing or housing 10a which supports at least one media supply tray 12, which by way of a picker arm 13, feeds cut sheets of print receiving media 12a (e.g., paper) into the media path 11, past the print engine which forms in the present instance part of the cartridge 30, and through the machine 10. A transport motor drive assembly 15 (FIG. 3) affords the driving action for feeding the media through and between the nips of pinch roller pairs 16-23 into a media receiving output tray 26.

In accordance with the invention, and referring now to FIGS. 1 & 2, the cartridge 30 includes an encoder wheel 31 adapted for coaction, when the cartridge 30 is nested in its home position within the machine 10, with an encoder wheel sensor or reader 31a for conveying or transmitting to the machine 10 information concerning cartridge characteristics including continuing data (while the machine is running) concerning the amount of toner remaining within the cartridge and/or preselected cartridge characteristics, such as for example, cartridge type or size, toner capacity, toner type, photoconductive drum type, etc. To this end, the encoder wheel 31 is mounted, in the illustrated instance on one end 32a of a shaft 32, which shaft is coaxially mounted for rotation within a cylindrical toner supply sump 33. Mounted on the shaft 32 for synchronous rotation with the encoder wheel 31, extending radially from the shaft 32 and axially along the sump 33 is a toner agitator or paddle 34. The toner 35 level for a cartridge (depending upon capacity) is generally as shown extending from approximately the 9:00 position and then counter clockwise to the 3:00 position. As the paddle 34 rotates counter clockwise in the direction of the arrow 34a, toner tends to be moved over the sill 33a of the sump 33. (The paddle 34 is conventionally provided with large openings 34b, FIG. 3, to provide lower resistance thereto as it passes through the toner 35.) As best shown in FIGS. 2 & 3, the toner that is moved over the sill 33a, is presented to a toner adder roll 36, which interacts in a known manner with a developer roll 37 and then a photoconductive (PC) drum 38 which is in the media path 11 for applying text and graphical information to the print receiving media 12a presented thereto in the media path 11.

Referring now to FIG. 3, the motor transport assembly 15 includes a drive motor 15a, which is coupled through suitable gearing and drive take-offs 15b to provide multiple and differing drive rotations to, for example, the PC drum 38 and a drive train 40 for the developer roll 37, the toner adder roll 36 and through a variable torque arrangement, to one

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end 32b of the shaft 32. The drive motor 15a may be of any convenient type, e.g. a stepping motor or in the preferred embodiment a brushless DC motor. While any of several types of motors may be employed for the drive, including stepping motors, a brushless DC motor is ideal because of the availability of either hall effect or frequency generated feedback pulses which present measurable and finite increments of movement of the motor shaft. The feedback accounts for a predetermined distance measurement, which will be referred to as an increment rather than a 'step' so as not to limit the drive to a stepping motor.

The drive train 40, which in the present instance forms part of the cartridge 30, includes driven gear 40a, which is directly coupled to the developer roll 37, and through an idler gear 40b is coupled to the toner adder roll 36 by gear 40c. Gear 40c in turn through suitable reduction gears 40d and 40e drives final drive gear 41. In a manner more fully explained below with reference to FIGS. 5 & 6, the drive gear 41 is coupled to the end 32b of shaft 32 through a variable torque sensitive coupling.

In FIG. 3, the gear 41 is shown as including an attached web or flange 42 connected to a collar 43 which acts as a bearing permitting, absent restraint, free movement of the gear 41 and its' web 42 about the end 32b of the shaft 32. Referring now to FIG. 4, the driving half of the variable torque sensitive coupling is mounted on the web 42 of the gear 41. To this end, the driving half of the coupling includes a coiled torsion spring 44, one leg 44a of which is secured to the web 42 of the gear 41, the other leg 44b of which is free standing.

Turning now to FIG. 5A, the other half (driven half) of the coupling is illustrated therein. To this end, an arbor 45 having a keyed central opening 46 dimensioned for receiving the keyed (flat) shaft end 32b of the shaft 32, is depicted therein. For ease of understanding, an inset drawing is provided wherein the reverse side of the arbor 45 is shown. The arbor 45 includes radially extending ear portions 47a, 47b, the extended terminal ends of which overlay the flange 48 associated with the web 42 of the gear 41. The rear face or back surface 45a of the arbor 45 (see FIG. 5B) confronting the web 42, includes depending, reinforcing leg portions 49a, 49b. A collar 46a abuts the web 42 of the gear 41 and maintains the remaining portion of the arbor 45 spaced from the web 42 of the gear 41. Also attached to the rear of the back surface 45a of the arbor 45 is a clip 50 which grasps the free standing leg 44b of the spring 44.

Thus one end 44a (FIG. 4) of the spring 44 is connected to the web 42 of the gear 41, while the other end 44b of the spring 44 is connected to the arbor 45 which is in turn keyed to the shaft 32 mounted for rotation in and through the sump 33 of the cartridge 30. Therefore the gear 41 is connected to the shaft 32 through the spring 44 and the arbor 45. As the gear 41 rotates, the end 44b of the spring presses against the catch 50 in the arbor 45 which tends to rotate causing the paddle 34 on the shaft 32 to rotate. When the paddle first engages the toner 35 in the sump 33, the added resistance causes an increase in torsion and the spring 44 tends to wind up thereby causing the encoder wheel 31 to lag the rotational position of the gear 41. Stops 51 and 52 mounted on the flange 48 prevent over winding or excessive stressing of the spring 44. In instances where the sump 33 is at the full design level of toner 35, the ears 47a, 47b engage the stops 52 and 51 respectively. The spring 44 therefore allows the paddle shaft 32 to lag relative to the gear 41 and the drive train 40 because of the resistance encountered against the toner 35 as the paddle 34 attempts to move through the sump 33. The more resistance encountered because of toner

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against the paddle 34, the greater the lag. As shall be described in more detail hereinafter, the difference in distance traveled by the gear 41 (really the motor 15a) and the encoder wheel 31, as the paddle 34 traverses the sump 33 counter clockwise from the 9:00 position (see FIG. 2,) to about the 5:00 position, is a measure of how much toner 35 remains in the sump 33, and therefore how many pages may yet be printed by the EP machine or printer 10 before the cartridge 30 is low on toner. This measurement technique will be explained more fully with regard to finding the home position of the encoder wheel 31 and reading the wheel.

Turning now to FIG. 6 which is a simplified electrical diagram for the machine 10, illustrating the principal parts of the electrical circuit thereof, the machine employs two processor (micro-processor) carrying boards 80 and 90, respectively labeled "Engine Electronics Card" and "Raster Image Processor Electronics Card" (hereinafter called EEC and RIP respectively). As is conventional with processors, they include memory, I/O and other accouterments associated with small system computers on a board. The EEC 80, as shown in FIG. 6, controls machine functions, generally through programs contained in the ROM 80a on the card and in conjunction with its on-board processor. For example, on the machine, the laser printhead 82; the motor transport assembly 15; the high voltage power supply 83 and a cover switch 83a which indicates a change of state to the EEC 80 when the cover is opened; the Encoder Wheel Sensor 31a which reads the code on the encoder wheel 31 informing the EEC 80 needed cartridge information and giving continuing data concerning the toner supply in the sump 33 of the EP cartridge 30; a display 81 which indicates various machine conditions to the operator, under control of the RIP when the machine is operating but capable of being controlled by the EEC 80 during manufacturing, the display being useful for displaying manufacturing test conditions even when the RIP is not installed. Other functions such as the Erase or quench lamp assembly 84 and the MPT paper-out functions are illustrated as being controlled by the EEC 80. Other shared functions, e.g. the Fuser Assembly 86 and the Low Voltage Power Supply 87 are provided through an interconnect card 88 (which includes bussing and power lines) which permits communication between the RIP 90 and the EEC 80, and other peripherals. The Interconnect card 88 may be connected to other peripherals through a communications interface 89 which is available for connection to a network 91, non-volatile memory 92 (e.g. Hard drive), and of course connection to a host 93, e.g., a computer such as a personal computer and the like.

The RIP primarily functions to receive the information to be printed from the network or host and converts the same to a bit map and the like for printing. Although the serial port 94 and the parallel port 95 are illustrated as being separable from the RIP card 90, conventionally they may be positioned on or as part of the card.

Prior to discussing, via the programming flow chart, the operation of the machine in accordance with the invention, the structure of the novel encoder wheel 31 should be described. To this end, and referring now to FIG. 7, the encoder wheel 31 is preferably disk shaped and comprises a keyed central opening 31b for receipt by like shaped end 32a of the shaft 32. The wheel includes several slots or windows therein which are positioned preferably with respect to a start datum line labelled D0, for purposes of identification. From a "clock face" view, D0 resides at 6:00, along the trailing edge of a start/home window 54 of the wheel 31. (Note the direction of rotation arrow 34a.) The paddle 34 is schematically shown positioned at top-dead-center (TDC)

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with respect to the wheel 31 (and thus the sump 33). The position of the encoder wheel sensor 31a, although stationary and attached to the machine, is assumed, for discussion purposes, aligned with D0 in the drawing and positioned substantially as shown schematically in FIG. 1.

Because the paddle 34 is generally out of contact with the toner in the sump, from the 3:00 position to the 9:00 position (counter clockwise rotation as shown by arrow 34a), and the shaft velocity may be assumed to be fairly uniform when the paddle moves from at least the 12:00 (TDC) position to the 9:00 position, information concerning the cartridge 30 is preferably encoded on the wheel between 6:00 and approximately the 9:00 position. To this end, the wheel 31 is provided with radially extending, equally spaced apart, slots or windows 0-6, the trailing edges of which are located with respect to D0 and labelled D1-D7 respectively. Each of the slots 0-6 represents an information or data bit position which may be selectively covered as by one or more decals 96, in a manner to be more fully explained hereinafter with reference to FIG. 10. Suffice at this point that a plurality of apertures 56-59 are located along an arc with the same radius but adjacent the data slots or windows 0-6. Note that the spacing between apertures 56 and 57 is less than the spacing between apertures 58 and 59.

The coded data represented by combinations of covered, not-covered slots 0-6 indicate to the EEC 80 necessary information as to the EP cartridge initial capacity, toner type, qualified or unqualified as an OEM type cartridge, or such other information that is either desirable or necessary for correct machine operation. Adjacent slot 6 is a stop window 55 which has a width equal to the distance between the trailing edges of adjacent slots or windows e.g. D1=(D2-D1)=(D3-D2 etc.)=the width of window 55. Note that the stop window 55 is also spaced from the trailing edge of slot 6 a distance equal to the stop window width 55. That is, the distance D8-D7=twice the window 55 width while the window width of window 55 is greater than the width of the slots 0-6.

Adjacent slot 0, from approximately the 5:00 to the 6:00 position is a start/home window 54. The start/home window 54 is deliberately made larger than any other window width. Because of this width difference, it is easier to determine the wheel position and the start of the data bit presentation to the encoder wheel sensor 31a. The reason for this will be better understood when discussing the programming flow charts of FIG. 8A and 8B.

In order to provide information to the EEC 80 as to the lag of the encoder wheel 31 relative to the transport motor 15a position (counted increments), three additional slots or windows "a", "b" and "c" are provided at D9, D10 and D11 respectively. The trailing edge of slot "a", (angular distance D9) is 200° from D0; the trailing edge of slot "b" (angular distance D10) is 215° from D0 and the trailing edge of slot "c" (angular distance D11) is 230° from D0. From FIG. 7 it may be seen that when the slot "a" passes the sensor 31a at D0, the paddle 34 will have already passed bottom dead center (6:00 position) by 20°, (200°-180°); window or slot "b" by 35° (215°-180°), and slot "c" by 50° (230°-180°). The significance of the placement of the slots "a", "b" and "c" will be more fully explained, hereinafter, with respect to FIG. 9.

Referring now to FIGS. 8A and 8B which shows respectively a programing and functional flow chart illustrating the code necessary for machine start up, and the reading of information coded on the encoder wheel, including the measurement of toner 35 level in the toner sump 33. At the

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outset, it is well that it be understood that there is no reliance on or measurement of the speed of the machine, as it differs depending upon the operation (i.e., resolution; toner type; color etc.) even though a different table may be required for look up under gross or extreme speed change conditions. Accordingly, rather than store in the ROM 80a a norm for each of several speeds to obtain different resolutions to which the actual could be compared to determine the amount of toner left, what is read instead is the angular 'distance' traversed by the encoder wheel 31 referenced to the angular distance travelled by the motor, and then comparing the difference between the two angular measurements to a norm

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start position of the wheel, since the engine could be stopped in, for instance, the stop window 55 position and due to backlash in the system, the motor may move enough distance before the encoder wheel actually moves that the measured "total window width" could appear to be the start/home window 54. Below is set forth in pseudo code the portion of the program for finding the start/home window 54. As previously discussed, the start/home window 54 is wider than the stop window 55 or for that matter, any other slot or window on the encoder wheel 31.

---

```

Find the home window first
' This loop runs on motor "increments"
HomeFound = False
while ( ! HomeFound)
  If (found the start of a Window) Then
    WindowWidth = 0
    While (not at the end of Window) {increment WindowWidth}
    If (WindowWidth > MINIMUM_HOME_WIDTH
      AND WindowWidth < MAXIMUM_HOME_WIDTH) Then
      HomeFound = True
  End if
End While

```

---

or base-line to determine the amount of toner 35 left in the sump 33. By observation, it can be seen that the distance that the encoder wheel travels between start or home (D0) and "a", "b", "c" is always the same. So what is being measured is the distance the motor has to travel before slot "a" is sensed, slot "b" is sensed and slot "c" is sensed, and then taking the difference as being the measured lag. In essence, and perhaps an easier way for the reader to understand what is being measured, is that the angular displacement of the paddle 34 is being measured with respect to the angular displacement of the gear 41 (gear train 40 as part of transport motor assembly 15). As discussed below, the greatest number (lag number) indicates the paddle position which gives the highest torque (the most resistance). This number indicates which look up table in ROM should be employed and gives a measure of how much toner 35 is left in the sump 33 of the cartridge 30.

Referring first to FIG. 8A, after machine 10 start up or the cover has been opened and later closed, the Rolling Average is reset, as shown in logic block 60. Simply stated, 'n' (e.g. 5 or 6) sample measurements are examined and the average of them is stored and the code on the encoder wheel 31 of the cartridge 30 is read, compared to what was there before, and then stored. The reason for doing this is that if a user replaces an EP cartridge since the last power on or machine 10 startup, there may be a different toner type, toner level etc. in the new sump. Accordingly, so as not to rely on the old data, new data is secured which includes new cartridge data and/or amount of toner 35 remaining in the cartridge 30. Therefore a new 'rolling average' is created in the EEC 80. With regard to host notification, the old data would be reported because the great majority of time when the machine is started up or the cover is closed once opened, a new cartridge will not have been installed, and reliance may usually be placed upon the previous information.

The next logical step at 61 is to 'Find the Home position' of the encoder wheel 31. In order for either the toner level or cartridge characteristics algorithms to operate properly, the "home position" of the wheel 31 must first be found. Necessarily, the EEC 80, through sensor 31a must see the start of a window before it begins determining the home or

In the above algorithm, 'HomeFound' is set false and a loop is run until the window or slot width meets the conditions of greater than minimum but less than maximum, then 'HomeFound' will be set true and the loop is ended. So the algorithm in essence is articulating: see the window; compare the window with predetermined minimum and maximum widths, for identification; and then indicate that the 'home window' 54 has been found when those conditions are met.

To ensure that the algorithm found home properly, after it identifies the stop window 55, it checks to ensure that the position of the stop window 55 is within reason with respect to the start/home window 54 and of course that the window width is acceptable. This occurs in logic blocks or steps 62, 63 and 64 in FIG. 8A. If this condition is not met, then the configuration information should be taken again. If this check passes, then there is no need to continue to look at the configuration information until a cover dosed or power on cycle occurs.

This guards against the potential conditions wherein the engine misidentifies the start/home window 54 and thus mis-characterizes the cartridge 30.

Prior to discussing the pseudo-code for 'Reading the Wheel', it may be helpful to recall that a portion of the encoder wheel's 31 revolution is close enough to constant velocity to allow that section to be used and read almost as a "windowed bar code". With reference to FIG. 7, that is the section of the wheel 31 from the trailing edge of the start/home window 54 to the trailing edge of the stop window 55 including the slots or windows 0-6. This is preferably in the section of the encoder wheel 31 in which the paddle 34 is not impinging upon or in the toner 35 in the sump 33. Passage of this section over the optical sensor 31 creates a serial bit stream which is decoded to gather read-only information about the cartridge. The information contained in this section may comprise information that is essential to the operation of the machine with that particular EP cartridge, or "nice to know" information. The information may be divided, for example into two or more different classifications. One may be cartridge 'build' specific, i.e. information which indicates cartridge size, toner capacity,



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toner type, photo conductor (PC) drum type, and is personalized when the cartridge is built, the other which may allow for a number of unique "cartridge classes" which may be personalized before cartridge shipment, depending, for example, upon the OEM destination. The latter classification may, for example inhibit the use of cartridges from vendors where it is felt that the cartridge will give inferior print, may have some safety concern, or damage the machine in some way. Alternatively, if the machine is supplied as an OEM unit to a vendor for his own logo, the cartridges may be coded so that his logo cartridge is that which is acceptable to the machine. The selective coding by blocking of the windows may be performed via a stick-on-decal operation which will be more fully explained with reference to FIG. 10.

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The 'Find Home' code determines the start/home window 54 and measures the distance corresponding to the trailing edge of each window 0-6 from the trailing edge of the window 54. This acquisition continues until the engine detects the stop window 55 (which is designed to have a greater circumferential width than the data windows 0-6 but less than the start/home window 54). Using a few integer multiplications, the state of each bit in the byte read is set using the recorded distance of each window 0-6 from the trailing edge of the home window 54.

The portion of the program for reading the encoder wheel, in pseudo-code, is as follows:

---

```
'Find Home' (see above)
' Gather distances for all of the data window
' This loop runs on motor "increments"
Finished = False
WindowNumber = 0
CumulativeCount = 0
while (!Finished)
    CumulativeCount = CumulativeCount + 1
    If (the start of a window is found) Then
        WindowWidth = 0
        While (not at the end of Window)
            increment WindowWidth
            increment CumulativeCount
        End While
    If (WindowWidth > Minimum Stop window Width
        AND WindowWidth < Maximum Stop Window Width
        AND CumulativeCount > Minimum Stop Position
        AND CumulativeCount < Maximum Stop Position)Then
        ' we must ensure that the stop window is really what we found
        Finished = True
        StopDistanceFromHome = CumulativeCount
    Else
        DistanceFromHome(WindowNumber) = CumulativeCount
        WindowNumber = WindowNumber + 1
    End if check for stop window
End if check for start of window
End While
' Now translate measurements into physical bits
DataValue = 0
' First divide the number of samples taken by 9
BitDistance = StopDistanceFromHome / 9
FOR I = 0 To WindowNumber - 1
    BitNumber = DistanceFromHome(I) / BitDistance
    'What is being determined is the bit number corresponding to the
    ' measurement by rounding up DistanceFromHome(I)/BitDistance.
    If ((DistanceFromHome(I) - (BitDistance * BitNumber)) * 2 > BitDistance)
    Then
        BitNumber = BitNumber + 1
    End If
    DataValue = DataValue + 1 (SHIFLEFT) BitNumber - 1
Next I Window number
DataValue = -DataValue ' invert result since windows are logic 0's
```

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The program depicted above in pseudo code for reading the wheel is quite straight forward. Thus in logic step 63, (FIG. 8A) where the motor increments are recorded for each data bit, and stop bit trailing edge, as was discussed with regard to FIG. 7 that the distances D1-D7 between the trailing edges of windows or slots 0 through 6, are equally spaced. (i.e., D7-D6=some constant "K", D5-D4=some constant "K" etc.) The trailing edge of the stop window 55 is also a distance of twice "K" from the trailing edge of slot 6. While the distance from the trailing edge of stop window 55 to its leading edge (i.e. the window 55 width) is equal to one 'bit' distance or "K" from the leading edge, this width may be any convenient distance as long as its' width is > than the width of the slots 0-6 and < the width of the start/home window 54. Thus

the line of pseudo code above 'First divide the number of samples taken by 9', (from the trailing edge of the start/home window or slot 54) means that there are 7 bits from D1 through D7, plus two more through D8, and therefore '9' gives the spacing "K" between the windows (trailing edge of the start/home window 54 to the trailing edge of the stop window 55) which may be compared to what this distance is supposed to be, and in that manner insure that the bit windows 0-6 and stop window 55 have been found. If the stop window 55 is not identified correctly by the technique just described, then a branch from logic step 64 to logic step 61 will once again initiate the code for finding the home position, as in block 61 and described above.

In logic block or step 65, the next logical step in the program is to go to the Data Encoding Algorithm portion of

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the program. In the pseudo code set forth above, this starts with the REM statement "Now translate measurements into physical bits". Now, assume that when coded, the encoder wheel 31 has several of the bits 0-6 covered, as by a decal so that light will not pass therethrough. Suppose all data bit slots but 6 and the stop window 55 are covered. A reading of distance D8/9 will give the sparing between the data slots or windows 0-6. Therefore, the distance to slot D7, i.e. the trailing edge of slot 6, will be 7 times "K" (bit sparing) and therefore will indicate that it is bit 7 that is emissive and that the bit representation is 1000000, or if the logic is inverted, 0111111. Notice that the number found is rounded up or down, as the case may be dependant upon such factors as paddle mass, rotational speed etc. In certain instances, this may mean rounding up with a reading above 0.2 and rounding down with a reading below 0.2. E.g., 6.3 would be rounded to 7, while 7.15 would be rounded to a 7.

In logic step 66 the question is asked: "Does the machine stop during paddle rotation?" If it does, logic step 67 is initiated. The reason for this is that if the paddle is stopped, especially when in the portion of the sump 33 containing a quantity of toner 35, in order to release the torsion on the spring 44 the motor 15a is backed up several increments. This will allow removal, and/or replacement, if desired, of the EP cartridge 30. This logic step allows for decrementing the number of steps "backed up" from the incremental count of motor increments which was started in logic block 62.

Turning now to FIG. 8B, as the encoder wheel 31 rotates, the paddle 34 enters the toner 35 in the sump 33. As described above relative to logic step 62, the motor increments are counted. The motor increments are then recorded as S200, S215 and S230, in logic step 68a, 68b and 68c at the trailing edges of slots "a", "b", and "c" respectively of the wheel 31. These numbers, S200, S215 and S230 are subtracted from the baseline of what the numbers would be absent toner 35 in the sump 33, (or any other selected norm) which is then directly indicative of the lag due to resistance of the toner in the sump, with the paddle 34 in three different positions in the sump. This is shown in logic steps 69a-69c respectively. As has previously been stated, there is a correlation between load torque on the toner paddle 34 and the amount of toner 35 remaining in the toner supply reservoir or sump 33. FIG. 9 illustrates this relationship. In FIG. 9, torque is set in inch-ounces on the ordinate and degrees of rotation of the paddle 34 on the abscissa.

Referring briefly to FIG. 9, several characteristics of this data stand out as indicating the amount of toner remaining. The first one is the peak magnitude of the torque. For example, with 30 grams of toner 35 remaining in the sump 33, the torque is close to 2 inch-ounces, while at 150 grams the torque approximates 4 inch-ounces and at 270 grams the torque approximates 8 inch-ounces. The second characteristic is that the location of the peak of the torque curve does not move very much as the amount of toner changes. This suggests that measuring the torque near the location where the peak should occur could provide a measure of remaining toner. That is why, as shown in FIG. 7, the trailing edge of slot "a", (distance D9) is 200° from D0; the trailing edge of slot "b" (distance D10) is 215° from D0 and the trailing edge of slot "c" (distance D11) is 230° from D0. Another obvious indicator is the location of the onset of the torque load. Yet a third indicator is the area under the torque curves.

Another way of looking at this process is that while the angular distance measurements of D9, D10 and D11 are known, the number of increments the motor has to turn in order that the resistance is overcome as stored in the torsion spring 44, is the difference in distance the motor has to travel

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(rotational increments) to obtain a reading at window "a", then "b" and then "c". The delay is then compared as at logic step 70 and 71, and the largest delay is summed as at logic steps 72, 73 or 74 to the rolling average sum. Thereafter a new average calculation is made from the rolling average sum. This is shown in logic step 75. As illustrated in logic block 76, the toner 35 level in the sump 33 may then be determined from a look up table precalculated and stored in the ROM 80a associated with the EEC 80 in accordance with the new rolling average.

In logic block 77, the oldest data point is subtracted from the rolling average sum and then the rolling average sum is reported for use back to logic block 61 (Find Home position). If the toner level changed from the last measurement, as in compare logic block 78, this condition may be reported to the local RIP processor 90 and/or the host machine, e.g. a personal computer as indicated in logic block 79.

Coding of the encoder wheel 31 is accomplished, as briefly referred to above, by covering selected ones of slots 0-6 with a decal. For customization for an OEM vendee, and in order to reduce inventory, and in accordance with another feature of the invention, the problem of quickly and accurately applying such a decal to the correct area of the wheel 31, even under circumstances of limited space, is provided. Due to the close spacing of the slots 0-6 in the encoder wheel 31, a pre-cut, preferably adhesive backed decal 96 is employed to selectively cover pre-selected slots depending on how the decal is cut or stamped. Very accurate positioning of the decal 96 is achieved by use of alignment pins in conjunction with an alignment tool 100. Because another decal can be placed on another region of the wheel, the sparing of the alignment holes 56-59 on the encoder wheel 31 is different in each region.

To this end, as previously discussed, there are two pairs of apertures in the encoder wheel or disk, adjacent the slots, the apertures of one of the pairs 58, 59 being spaced apart a greater distance than the apertures 56-57 of the other of the pairs. Referring now to FIG. 10, a decal 96 is sized to fit over at least one of the slots 0-2, or 3-6 to cover the same. As illustrated, the decal 96 has spaced apart apertures therein corresponding to one of the pairs of apertures, i.e. 58, 59 or 56, 57. A tool 100 has a pair of pins 97, 98 projecting therefrom and corresponding to the sparing of one of the pairs of apertures, whereby when the apertures in the decal are mated with the projecting pins of the tool, the projecting pins of the tool may be mated with the one pair of apertures in the encoder wheel or disk to thereby accurately position the decal over the selected slot in the disk. The decal 96 is installed on the tool with the adhesive side facing away from the tool. The tool 100 is then pushed until the decal 96 makes firm contact with the surface of the wheel.

If the pins 97 and 98 are spaced equal to the sparing between apertures 56 and 57, the decal cannot, once on the tool 100, be placed covering slots associated with the incorrect apertures 58 and 59. The opposite condition is also true. Accordingly, two such tools 100 with different pin 97, 98 spacing may be provided to insure proper placement of the correct decal for the proper slot coverage. Alternatively, a single tool 100 with an extra hole for receipt of a transferred pin to provide the correct spacing, may be provided.

This method of selective bit blocking is preferred because the process is done at the end of the manufacturing line where less than all of the wheel 31 may be exposed. Use of this tool 100 with differing spaced apart pins allows the operator to get to the encoder wheel 31 easily and prevents misplacement of the decal.

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Thus the present invention provides a simple yet effective method and apparatus for transmitting to a machine of a type employing toner, information concerning the characteristics of an EP cartridge, but also combines with such information continuing data relating to the amount of toner left in the cartridge during machine operation. In this connection the present invention provides suitable software to automatically determine, upon machine power-on-reset (POR) or other resumption of functions, whether conditions have changed or altered since the last period of running of the machine, and to alter the machine running conditions in view of those determinations or findings. Moreover, the present invention provides a simplified, but effective method and means for changing the initial information concerning the cartridge, which means and method is accurate enough and simple enough to allow for either in field alterations or end of manufacturing coding of the EP cartridge. The present invention provides, in a single encoder wheel associated with the supply EP cartridge, information which is essential for proper and efficient operation of the machine but which also provides on-going information concerning the amount of toner left in the cartridge for continued use.

Although the invention has been described with a certain degree of particularity, it should be recognized that elements thereof may be altered by person(s) skilled in the art with out departing from the spirit and scope of the invention as hereinafter set forth in the following claims.

What is claimed is:

1. A cartridge for an electrophotographic machine, comprising:

- a sump for carrying an initial quantity of toner;
- a shaft mounted for rotation in said sump, and a paddle mounted thereon in such a manner that when said shaft rotates, said paddle rotates therewith, into, through and out of engagement with toner carried within said sump;
- an encoder wheel mounted on said shaft, externally of said sump; said encoder wheel positioned for mating coaction with a code wheel reader when said cartridge is in a home position in an electrophotographic machine; and
- a torque sensitive coupling connected to said shaft for connection to a drive means in said machine, when said cartridge is installed in said machine, to effect rotation of said shaft, paddle and encoder wheel;
- said encoder wheel configured for indicating, in conjunction with said coded wheel reader, one or more cartridge characteristics to said machine.

2. A cartridge for an electrophotographic machine in accordance with claim 1, wherein said encoder wheel includes;

- means on said encoder wheel for coaction with said code wheel reader on said machine to indicate a component of resistance to paddle movement through the portion of said sump having toner therein to give an indication of the amount of toner remaining in said sump.

3. A cartridge for an electrophotographic machine in accordance with claim 2, wherein:

- said encoder wheel is mounted on one side of said torque sensitive coupling; and,
- said drive means on said machine is connected to the other side of said torque sensitive coupling; and,
- said component of resistance is measured by the lag between drive means travel and encoder travel.

4. A cartridge for an electrophotographic machine in accordance with claim 1, including a section of said encoder wheel containing coded information indicating said one or more characteristics of said cartridge;

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said section positioned on said encoder wheel so that during normal rotational operation in said machine by drive means in said machine, said section is read by said code wheel reader prior to said paddle entering said toner material in said sump.

5. A cartridge for an electrophotographic machine in accordance with claim 4, said encoder wheel including;

another section on said encoder wheel configured for coaction with said code wheel reader on said machine to signify a component of resistance to paddle movement through the portion of said sump having toner therein to give an indication of the amount of toner remaining in said sump.

6. A cartridge for an electrophotographic machine in accordance with claim 5, wherein:

said encoder wheel is connected to one side of said torque sensitive coupling, by said shaft, and at one end of said cartridge,

the other side of said torque sensitive coupling being adapted for connection to said drive means and at the opposite end of said cartridge,

and said component of resistance is measured by the lag between drive means travel and encoder travel.

7. A cartridge for an electrophotographic machine in accordance with claim 1, wherein:

said encoder wheel comprises a disk having a keyed central aperture therein for located positioning thereof on said shaft in a predetermined and oriented placement relative to said paddle;

a home window in said disk positioned for detection by said code wheel reader when said cartridge is installed in a machine and upon rotation of said disk;

a plurality of serially positioned, equally spaced apart slots therein, adjacent said home window, for indicating, by covering or not covering of said slots, said one or more characteristics of said cartridge for communication to said machine, through said code wheel reader when said cartridge is installed in said machine.

8. A cartridge for an electrophotographic machine in accordance with claim 7, wherein:

said home or start window has a first different width than other windows or slots in said encoder wheel intended for reading by said code reader;

said disk also including a stop window adjacent to said slots and angularly spaced from said home window, said stop window having a second different width than other windows or slots in said encoder wheel intended for reading by said code wheel reader.

9. A cartridge for an electrophotographic machine in accordance with claim 8, said encoder wheel including:

a plurality of spaced apart slots positioned in said encoder wheel to be read by said code wheel reader when said paddle is rotating through different positions in toner in said sump.

10. A cartridge for an electrophotographic machine in accordance with claim 7 including in said cartridge;

a toner adder roll, a developer roll and a photo conductive drum;

a drive train comprising gears connected to said developer roll, toner adder roll and the driver side of said torque sensitive coupling.

11. A cartridge for an electrophotographic machine in accordance with claim 10 wherein said sump of said cartridge is cylindrical and includes first and second ends, and



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said encoder wheel is connected to the driven side of said torque sensitive coupling, by said shaft, and at a first end of said cartridge,

the driver side of said torque sensitive coupling being connected to said drive train for connection to said drive means and at the second end of said cartridge, means on said encoder wheel for coaction with said code wheel reader on said machine to indicate a component of resistance to paddle movement through the portion of said sump having toner therein to give an indication of the amount of toner remaining in said sump.

12. A cartridge for an electrophotographic machine in accordance with claim 11 wherein:

said component of resistance is measured by the lag between drive means travel and encoder travel when said cartridge is installed in said machine.

13. A cartridge for an electrophotographic machine in accordance with claim 12 wherein said torque sensitive coupling comprises:

a gear of said drive train mounted for rotation about said shaft;

a torsion spring having one end thereof connected to said gear;

an arbor connected to said shaft and including means on said arbor for connection to the opposite end of said torsion spring whereby when said gear rotates about said shaft the spring effects rotation through said arbor to said shaft said spring being torqued proportionally to the resistance encountered during paddle rotation through said sump.

14. An electrophotographic (EP) machine, comprising:

a replaceable EP cartridge having at least a sump for containing a supply of toner material;

drive means for moving print receiving media through the machine, and for effecting rotation of a paddle within said sump, into, through and out of toner material carried in said sump;

an encoder wheel on said cartridge, in a preselected and predetermined orientation with respect to said paddle in said sump and connected thereto, and a code wheel reader in mating relation with respect thereto when said cartridge is installed in said machine; and

a variable torque sensitive coupling connecting said drive means to said paddle to effect rotation thereof, said encoder wheel configured for indicating, in conjunction with said coded wheel reader, characteristics of the cartridge including a component of resistance to paddle movement as reflected in said torque sensitive coupling through the portion of said sump having toner therein to give an indication of the amount of toner remaining in said sump.

15. An electrophotographic (EP) machine in accordance with claim 14 including a shaft extending through said sump and connected to said paddle;

said encoder wheel comprising a disk having a keyed central aperture therein for located positioning thereof on said shaft in a predetermined and oriented placement relative to said paddle; P1 a home window in said disk positioned for detection by said code wheel reader upon rotation of said disk by said drive means;

a plurality of serially positioned, equally spaced apart slots in said disk, adjacent said home window, for indicating, by covering or not covering of said slots, one or more characteristics of said cartridge for communication to said machine, through said code wheel reader.

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16. An electrophotographic (EP) machine in accordance with claim 15 wherein:

said home or start window has a first different width than other windows or slots in said encoder wheel intended for reading by said code reader;

said disk also including a stop window adjacent to said slots and angularly spaced from said home window, said stop window having a second different width than other windows or slots in said encoder wheel for reading by said code wheel reader upon rotation of said disk.

17. An electrophotographic (EP) machine in accordance with claim 16 wherein said component of resistance is measured by the lag between said drive means travel and encoder travel.

18. An electrophotographic (EP) machine in accordance with claim 14 wherein said machine includes a processor coupled to said code wheel reader, a program in non-volatile memory associated with said processor for determining the home position of said disk, and a table in said non-volatile memory for comparing the measured lag with the lag associated with paddle resistance stored in said table and associated with predetermined quantities of toner in said sump.

19. An electrophotographic (EP) machine in accordance with claim 18 including another plurality of serially arranged slots in said disk positioned to be read at different locations of said paddle in toner in said sump, and look up tables in said memory for comparing the measured lag at each said another slot to determine the quantity of toner in said sump.

20. An electrophotographic (EP) machine in accordance with claim 14, including in said cartridge:

a toner adder roll, a developer roll and a photo conductive drum;

a drive train comprising gears connected to said developer roll, adder roll and the driver side of said torque sensitive coupling and to said drive means.

21. An electrophotographic (EP) machine in accordance with claim 20, wherein said sump of said cartridge is cylindrical and includes first and second ends, and

said encoder wheel is connected to the driven side of said torque sensitive coupling, by said shaft, and at a first end of said cartridge,

the driver side of said torque sensitive coupling being connected to said drive train for connection to said drive means and at the second end of said cartridge, said component of resistance being measured by the lag between drive means travel and encoder travel when said cartridge is installed in said machine.

22. An electrophotographic (EP) machine in accordance with claim 21, wherein said torque sensitive coupling comprises:

a gear of said drive train mounted for rotation about said shaft;

a torsion spring having one end thereof connected to said gear;

an arbor connected to said shaft and including means on said arbor for connection to the opposite end of said torsion spring whereby when said gear rotates about said shaft the spring effects rotation through said arbor to said shaft, said spring being torqued proportionally to the resistance encountered during paddle rotation through said sump.

23. A method of determining characteristics of a replaceable cartridge for an electrophotographic machine, said

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cartridge including a sump for holding toner therein and a paddle mounted for rotation within said sump, an encoder wheel mounted externally of said sump and connected to said paddle for rotation therewith, said wheel having a plurality of slots therein, some of said slots being coded for indicating characteristics of the cartridge when rotated by drive means for reading by a code wheel reader on said machine, comprising the steps of:

rotating said wheel and determining the home position of said wheel and the position thereon of encoded slots representing bits relative to the paddle in said sump of toner by counting drive means increments from a predetermined start or home position;

recording increments to encoded slots and stop window trailing edge;

subtracting an incremental count of said drive means as if no toner were in said sump from an actual incremental count to selected predetermined positions of said paddle in said sump containing toner to determine delay being measured in known distances traveled by said paddle under no toner to actual toner contained conditions;

and determining from said difference the quantity of toner remaining in said sump.

24. A method of determining characteristics of a replaceable cartridge for an electrophotographic machine in accordance with claim 23 wherein, if said machine stops, including the steps of:

counting the number of increments the drive means backs up; and

subtracting that number of increments from said count.

25. A method of determining characteristics of a replaceable cartridge for an electrophotographic machine in accordance with claim 24 including the step of:

checking for a correct position of a stop window relative to a start window.

26. A method of determining characteristics of a replaceable cartridge for an electrophotographic machine in accordance with claim 23 wherein said selected predetermined positions of said paddle, in said sump are angularly separated in the direction of rotation for reading serially during rotation subsequent to said paddle entering toner in said sump.

27. A method of determining characteristics of a replaceable cartridge for an electrophotographic machine in accordance with claim 26 including the steps of:

summing the delay, during prescribed revolutions of said paddle, and

calculating an average of such delays on a continuing basis to determine if said quantity of toner changed from the last reading.

28. A method of determining characteristics of a replaceable cartridge for an electrophotographic machine in accordance with claim 27 including the step of:

reporting toner level conditions to a user.

29. A method of determining characteristics of a replaceable cartridge for an electrophotographic machine in accordance with claim 28 including the steps of:

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continuing the steps of subtracting and determining for each rotation of said wheel.

30. A method of determining characteristics of a replaceable cartridge for an electrophotographic machine in accordance with claim 23 including the steps of:

continuing the steps of subtracting and determining for each rotation of said wheel.

31. An electrophotographic (EP) machine including a replaceable EP cartridge having at least a sump for containing a supply of toner material, said machine including a drive means for moving print receiving media through the machine, and for effecting rotation of a shaft extending into and out of said sump, said shaft having a paddle mounted thereto for rotation within said sump, into, through and out of toner material carried in said sump, comprising means for indicating characteristic information for said cartridge via a single encoded wheel coupled to said shaft.

32. A cartridge for an electrophotographic machine, comprising:

a sump for carrying a quantity of toner;

a toner agitator mounted in said sump; and

a single encoded wheel rotating in relation to said toner agitator, said encoded wheel including coding for determining a quantity of toner in said cartridge.

33. The cartridge of claim 32, wherein said coding comprises one or more openings formed in said wheel.

34. The cartridge of claim 33, wherein said one or more openings comprise a plurality of openings located in spaced relation in said wheel.

35. The cartridge of claim 34, wherein said wheel further comprises encoding for one or more preselected cartridge characteristics.

36. A toner cartridge for an imaging apparatus, the improvement comprising a wheel having coding representing one or more preselected cartridge characteristics.

37. The cartridge of claim 36, wherein at least one of said one or more preselected cartridge characteristics is formed on said wheel by one or more openings located in a section of said wheel.

38. The cartridge of claim 37, wherein a presence or absence of said one or more openings in said section of said wheel correspond to binary data for identifying said preselected characteristics of said cartridge.

39. The cartridge of claim 36, further comprising a plurality of openings in spaced relation in said wheel for use in measuring a quantity of toner in said cartridge.

40. The cartridge of claim 36, wherein said wheel is coded with said one or more preselected cartridge characteristics by covering at least one of a plurality of openings.

41. The cartridge of claim 36, wherein said coding comprises a plurality of openings in said wheel.

42. The cartridge of claim 36, wherein said wheel further comprises coding for determining a quantity of a toner carried by said cartridge.

\* \* \* \* \*

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Certifying Officer





US005758231A

**United States Patent** [19]

Coffey et al.

[11] **Patent Number:** 5,758,231[45] **Date of Patent:** May 26, 1998[54] **VENTING PLUG IN TONER CARTRIDGE**

[75] **Inventors:** Johnnie A. Coffey, Winchester; Steven Alan Curry, Nicholasville; Robert Flynt Streat, Lexington; Earl Dawson Ward, II, Richmond, all of Ky.

[73] **Assignee:** Lexmark International, Inc., Lexington, Ky.

[21] **Appl. No.:** 770,329[22] **Filed:** Dec. 20, 1996[51] **Int. Cl.<sup>6</sup>** ..... G03G 15/08; G03G 21/00

[52] **U.S. Cl.** ..... 399/106; 220/254; 220/371; 222/189.09; 399/93; 399/98

[58] **Field of Search** ..... 399/103, 106, 399/98, 93; 55/385.4, 441; 222/180.09, DIG. 1; 220/253, 254, 371

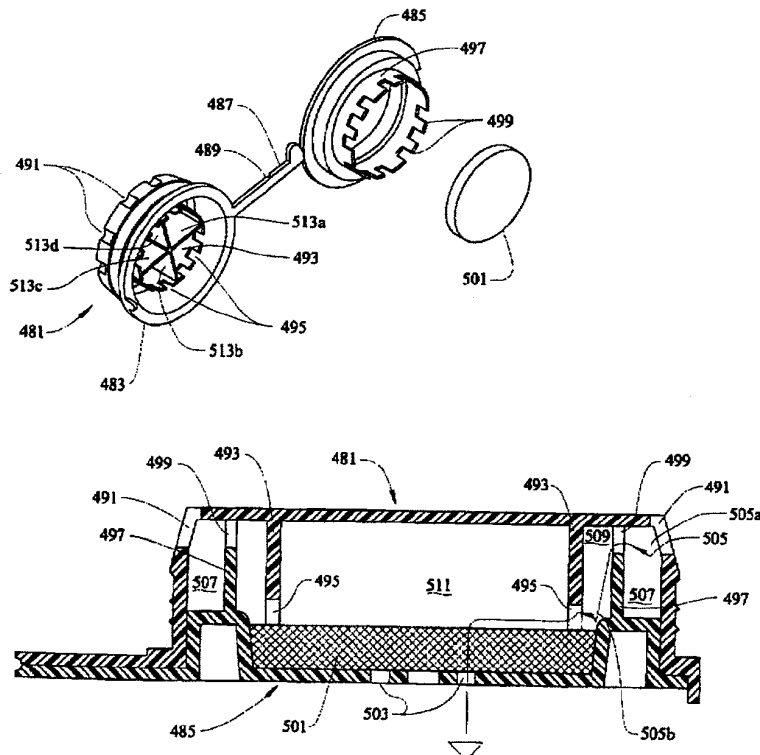
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*Primary Examiner*—Arthur T. Grimley*Assistant Examiner*—Sophia S. Chen*Attorney, Agent, or Firm*—John A. Brady[57] **ABSTRACT**

Hopper plug (143) vents out air pressure build-up which cause toner leaks. One side of the plug has a series of entrance openings (491) which communicate with the inside of the hopper (61). Air, potentially containing some toner particles, passes through those openings and enters a first chamber (507). The first chamber has exit holes (499) which do not face the entrance openings. Air passing through the exit holes of the first chamber enters a second chamber (509). The second chamber has exit holes (495) which are at the opposite end and do not face the entrance openings. Third chamber (511) of this labyrinth faces a mat toner filter (501) which leads to exit holes (503).

**16 Claims, 23 Drawing Sheets**



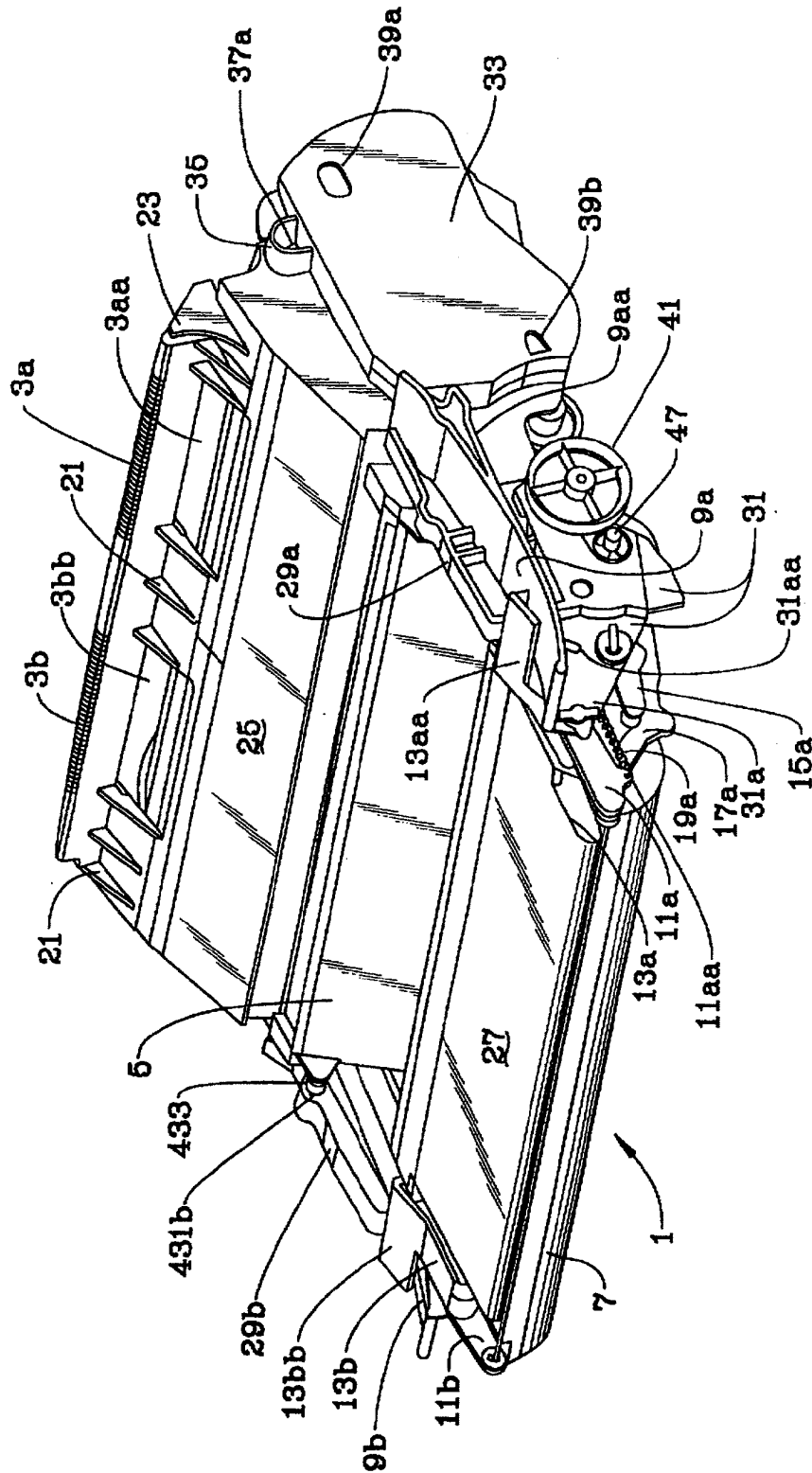
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FIG. 1

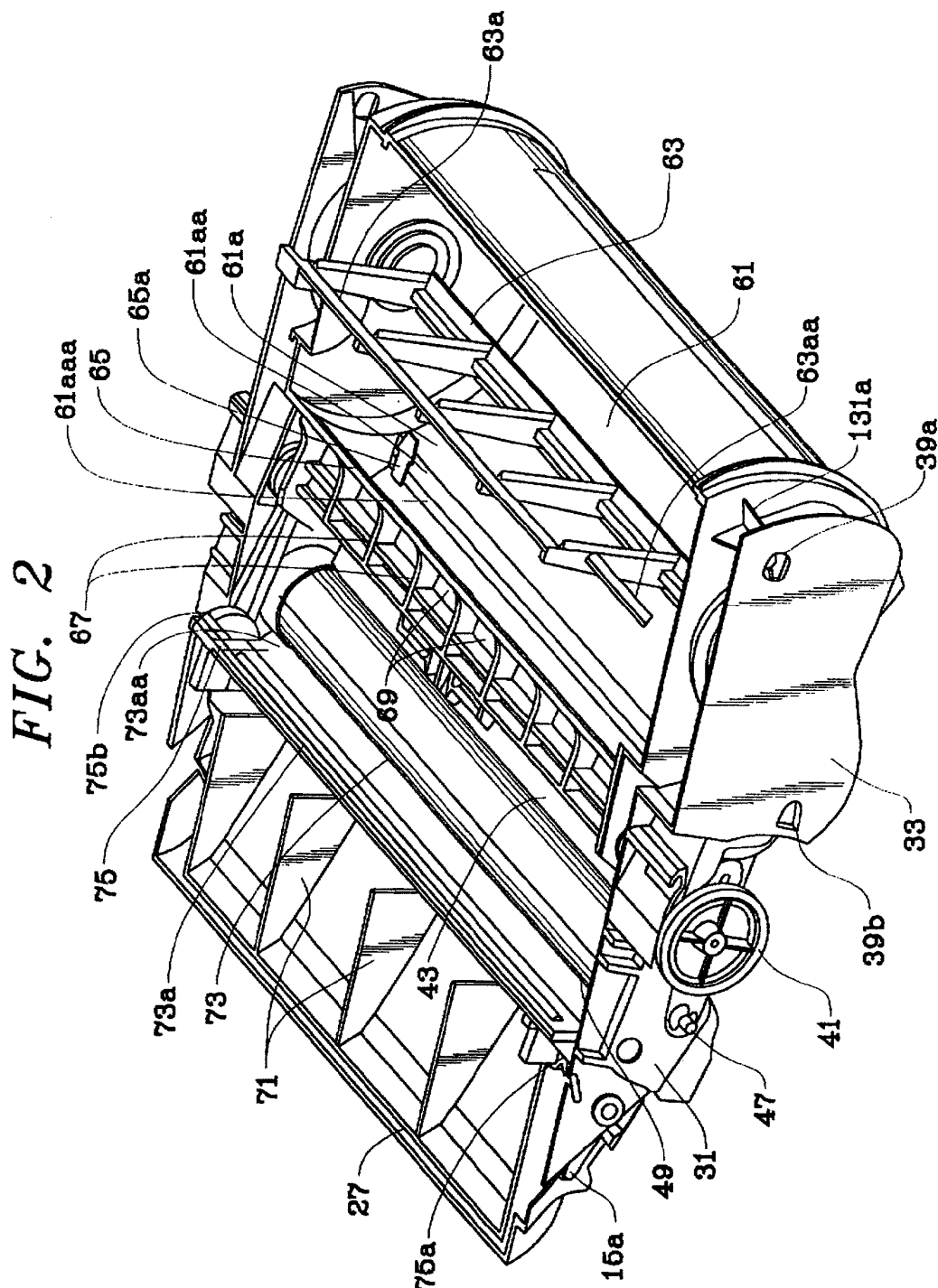


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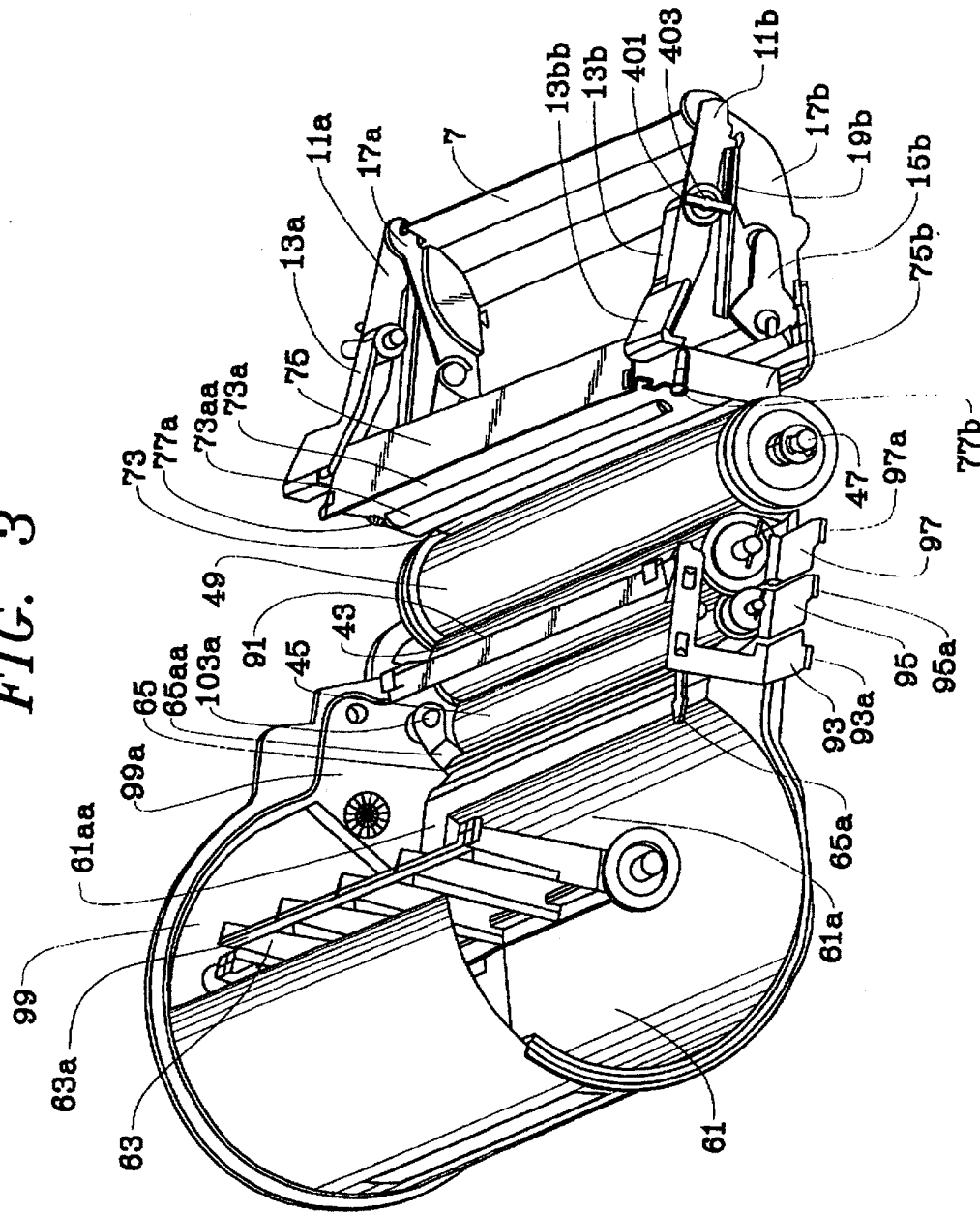
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FIG. 3

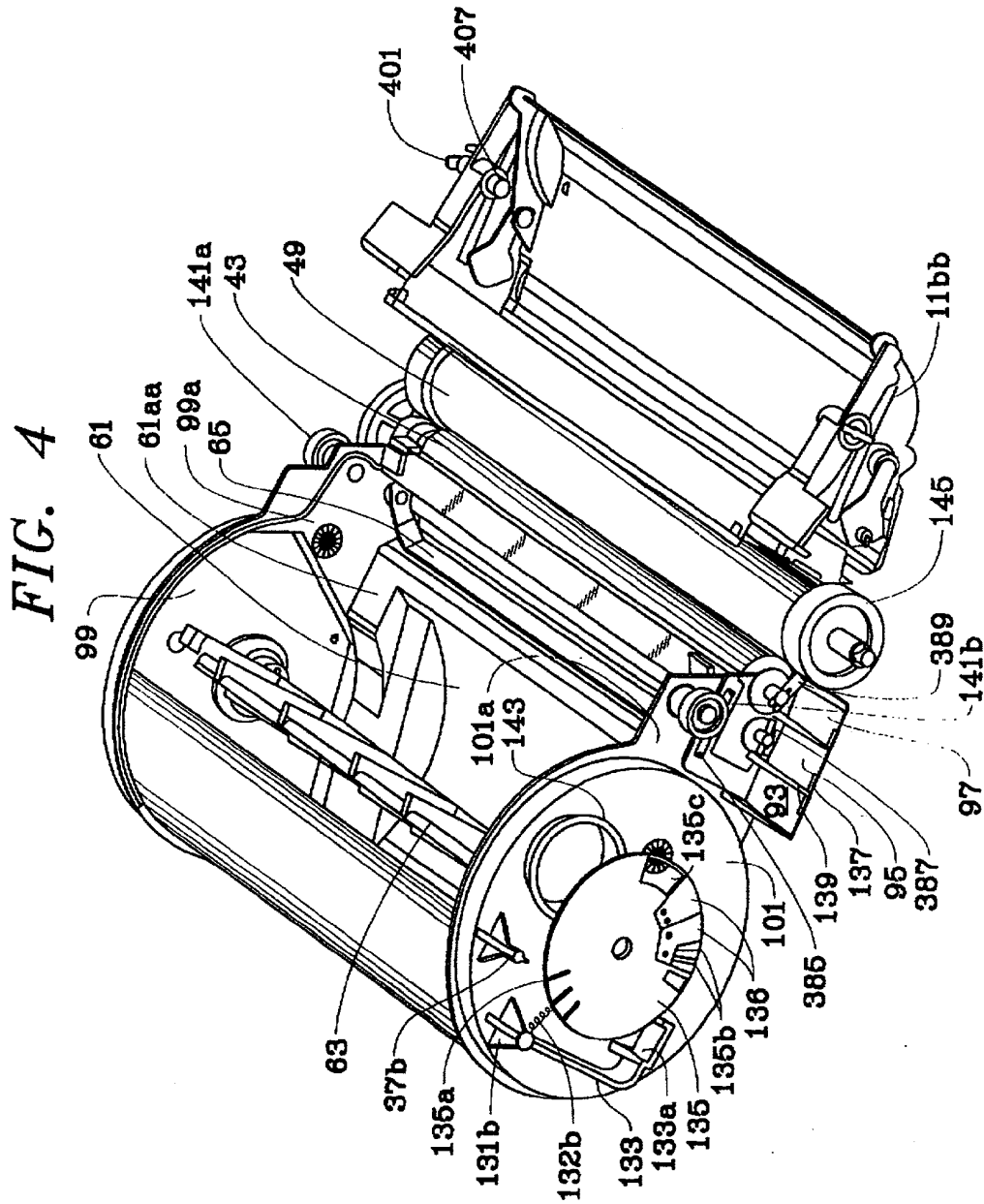


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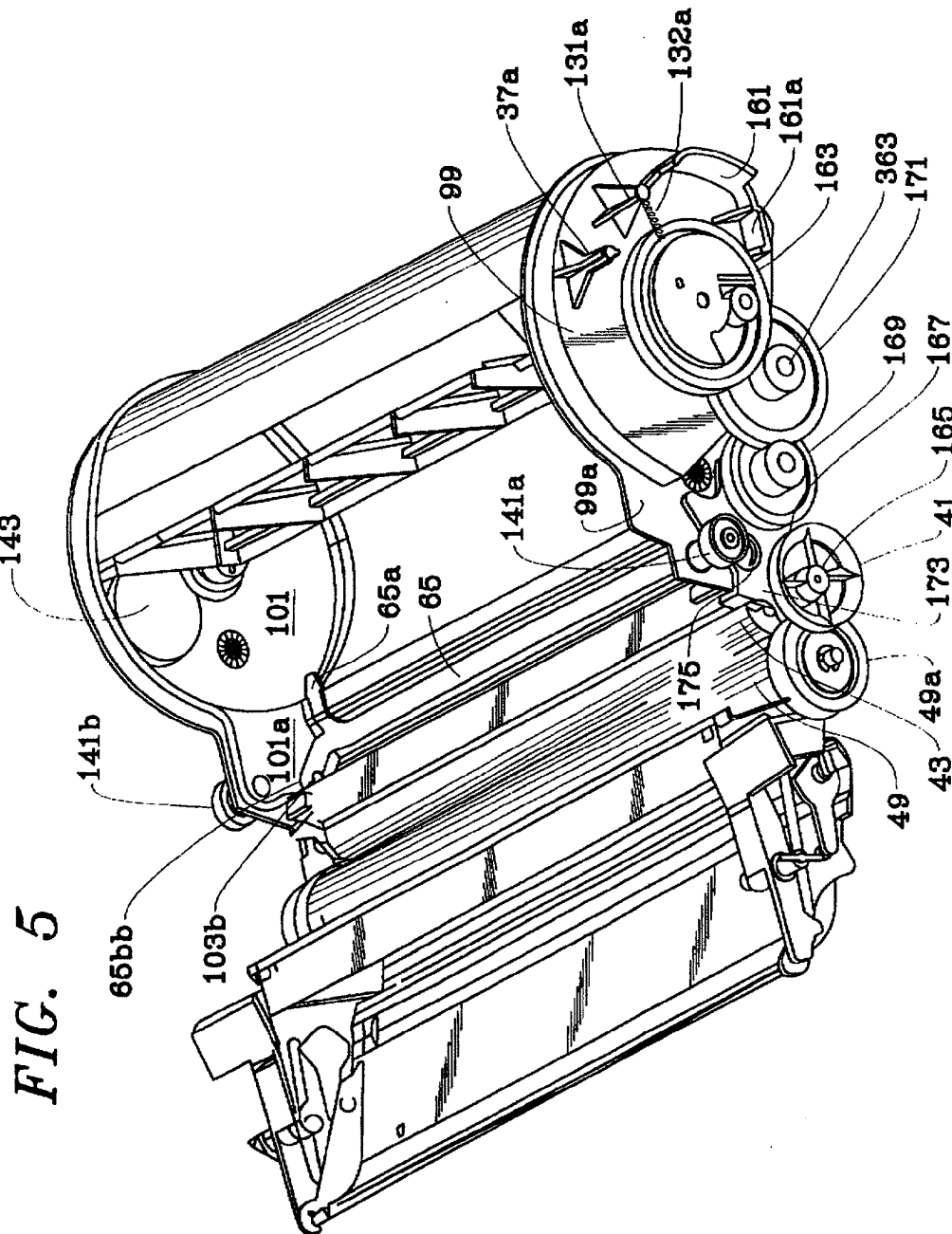


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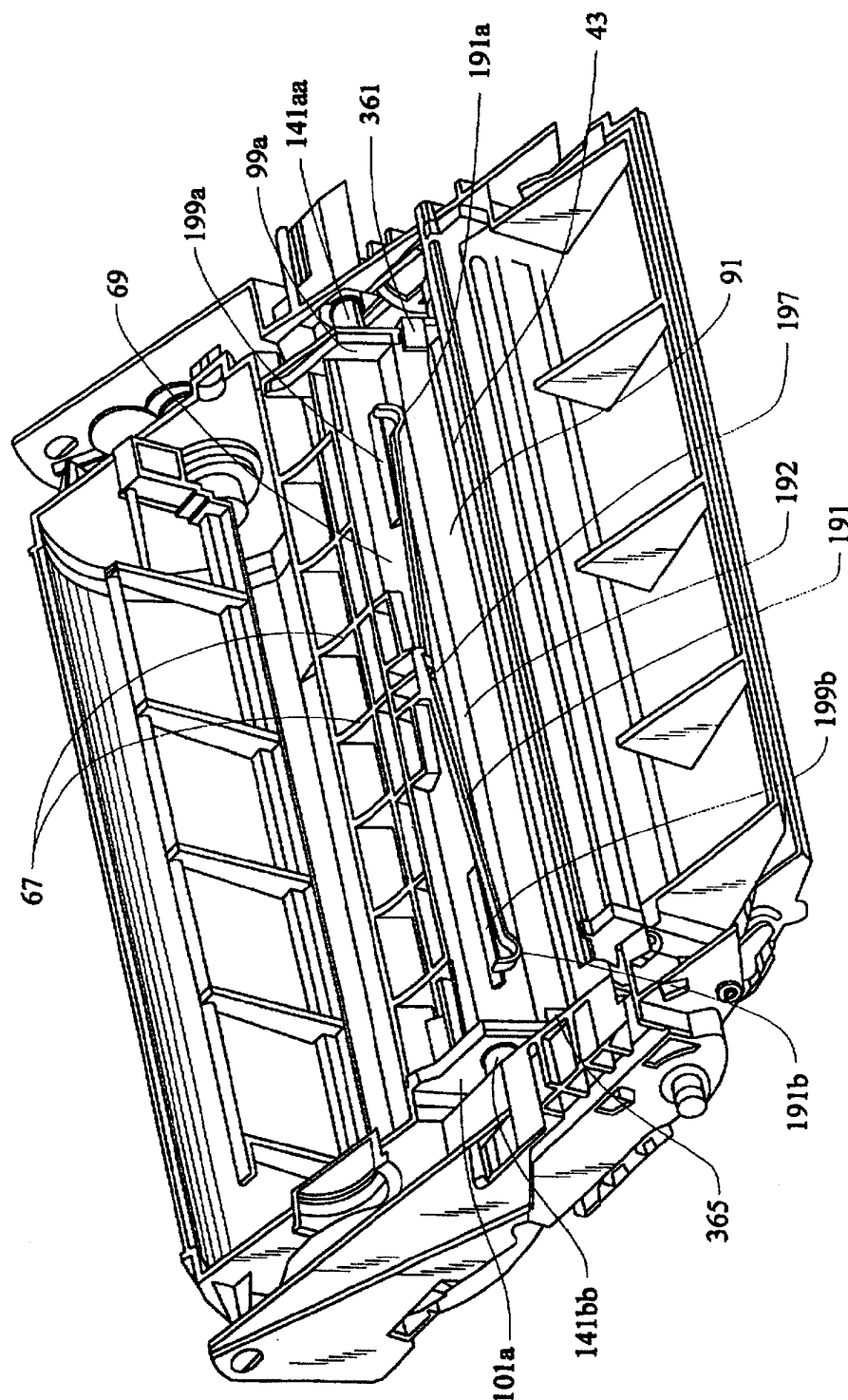
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FIG. 6



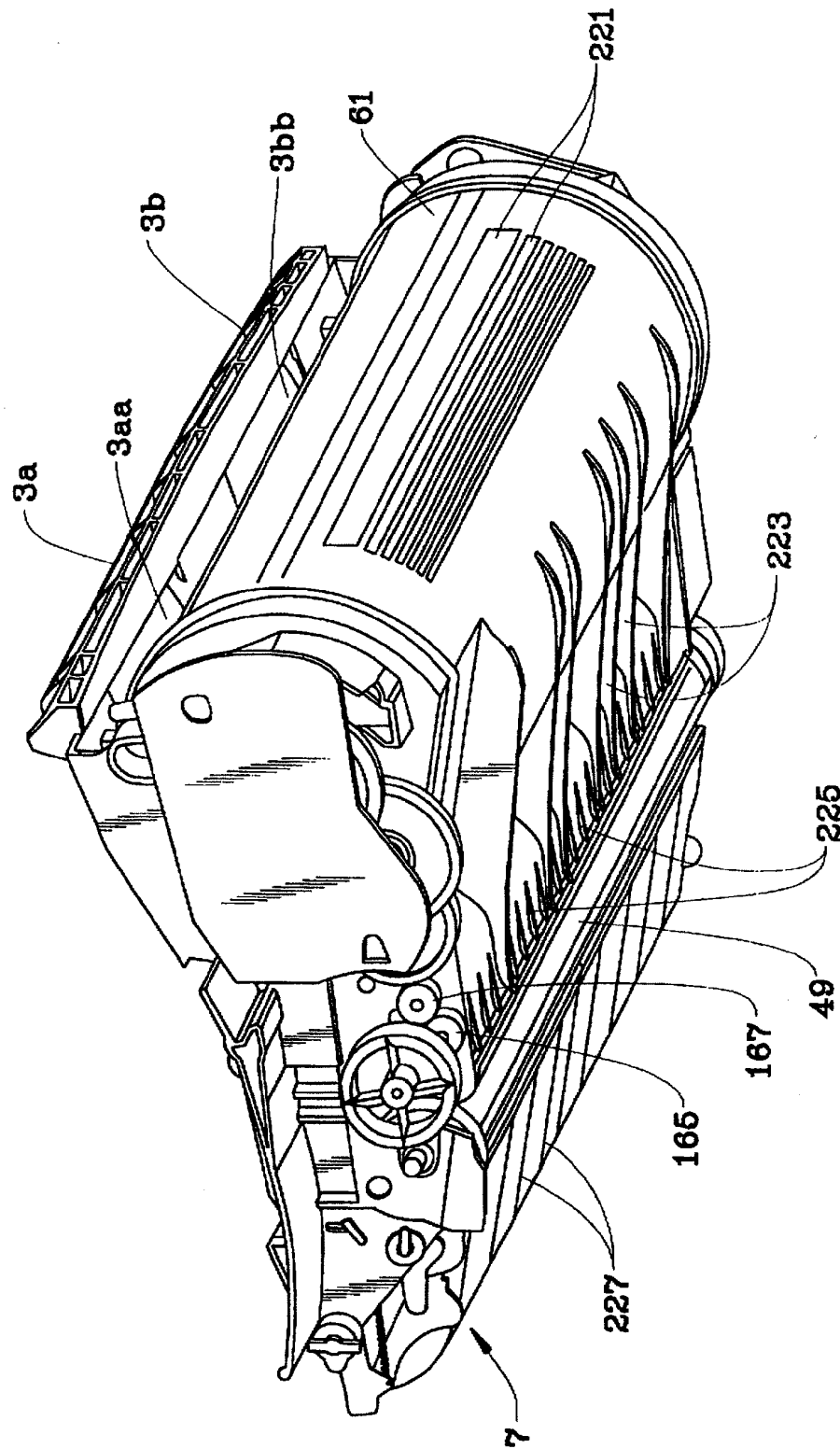
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**FIG. 7**





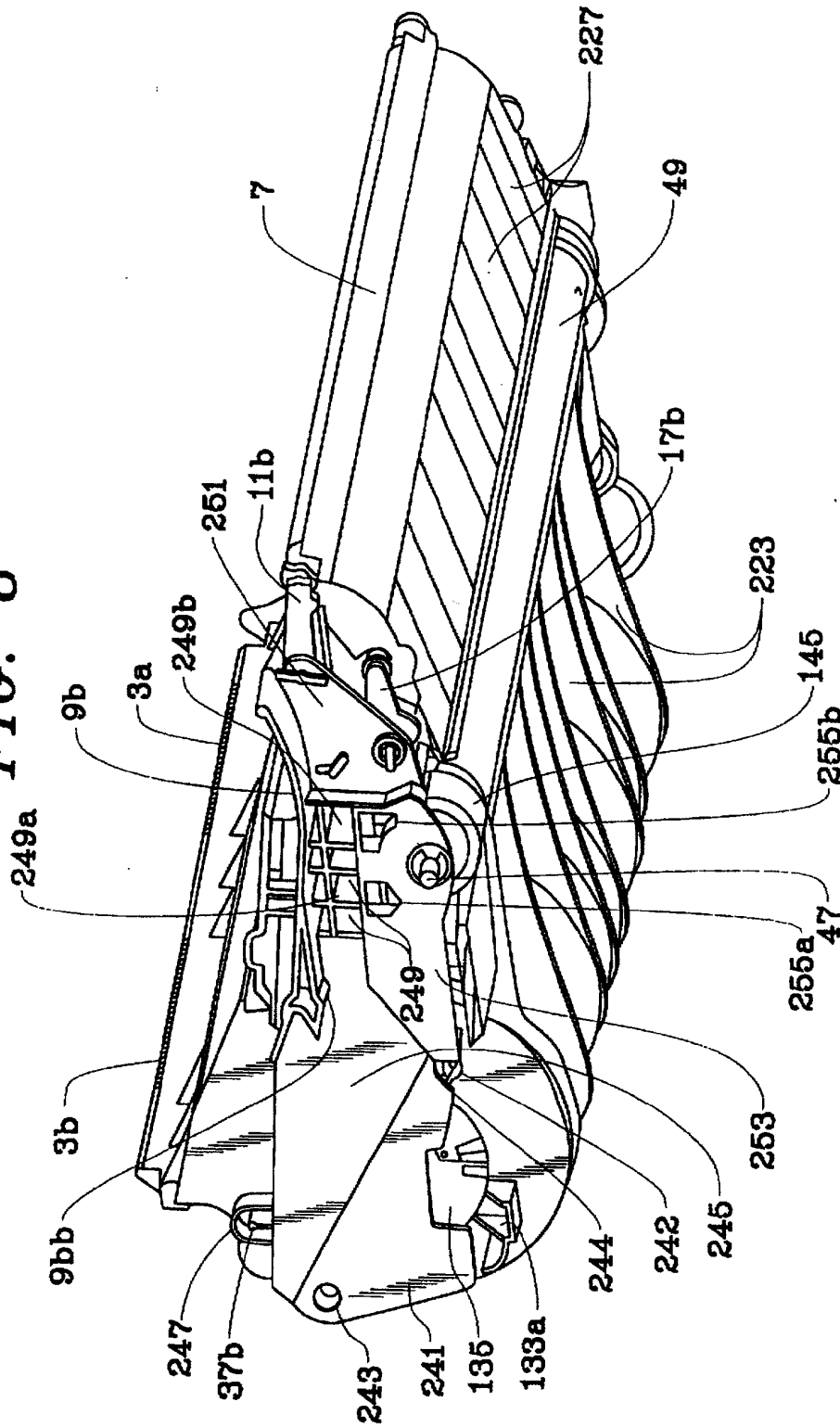
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FIG. 8



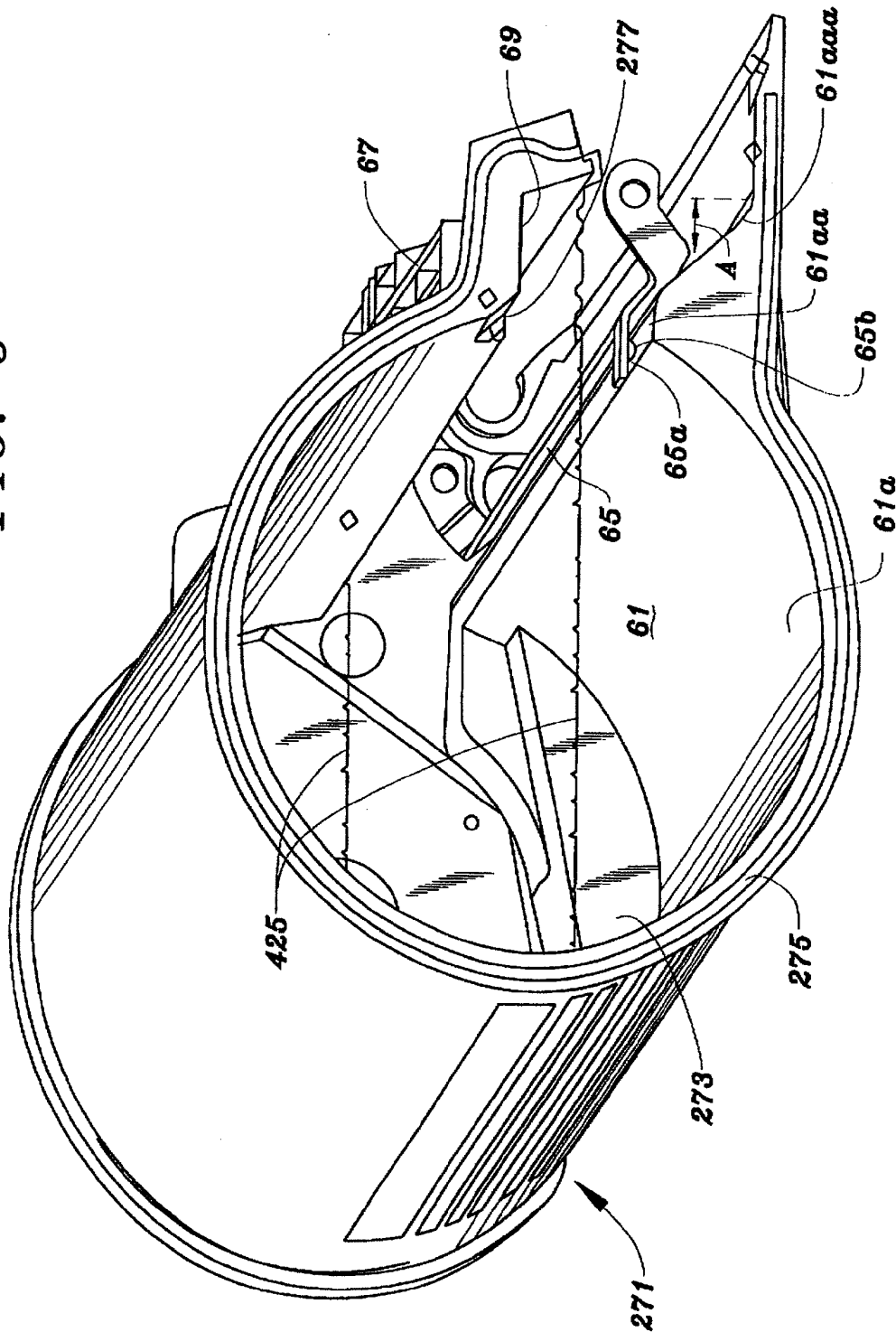
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FIG. 9



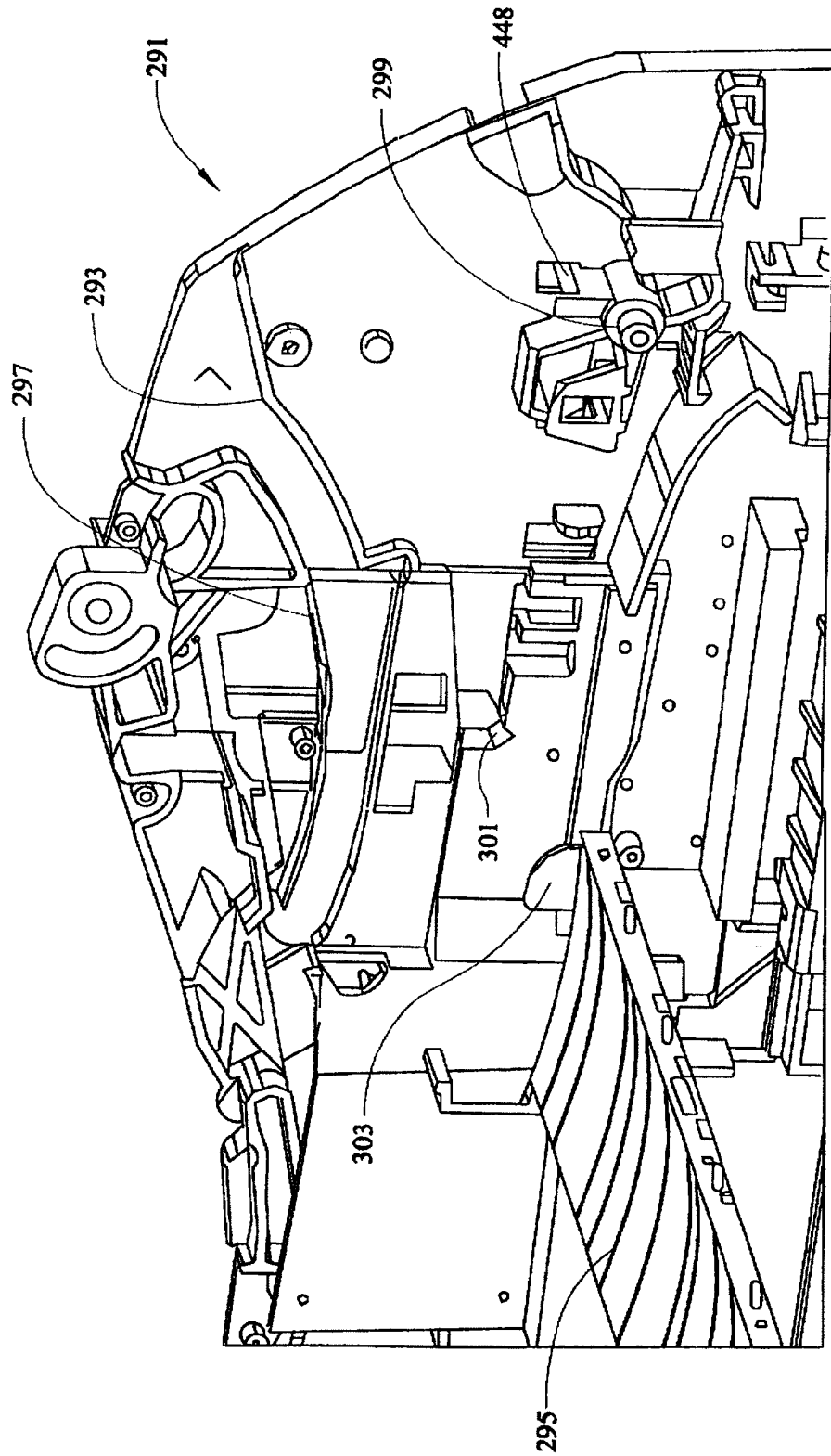
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FIG. 10



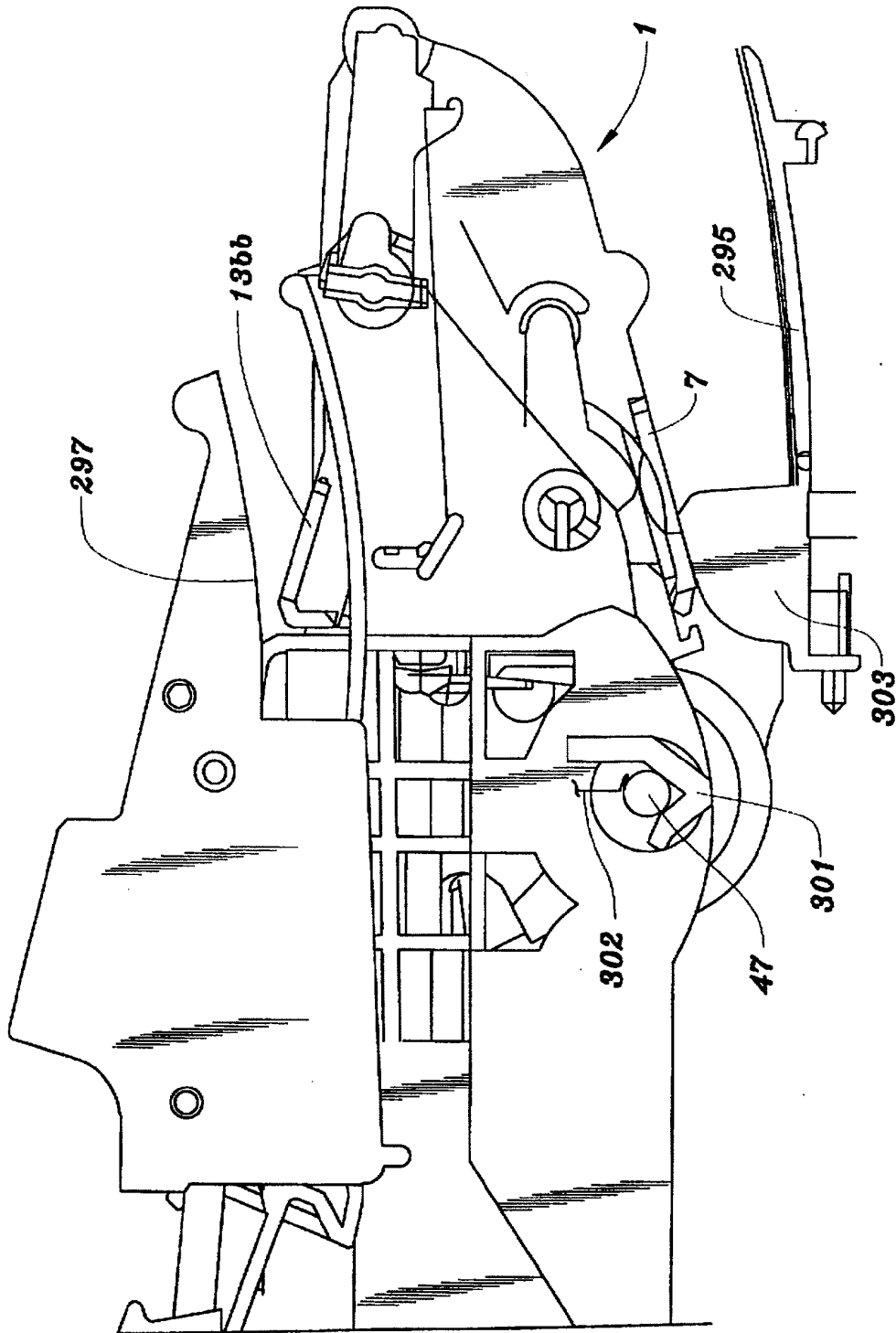
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FIG. 11

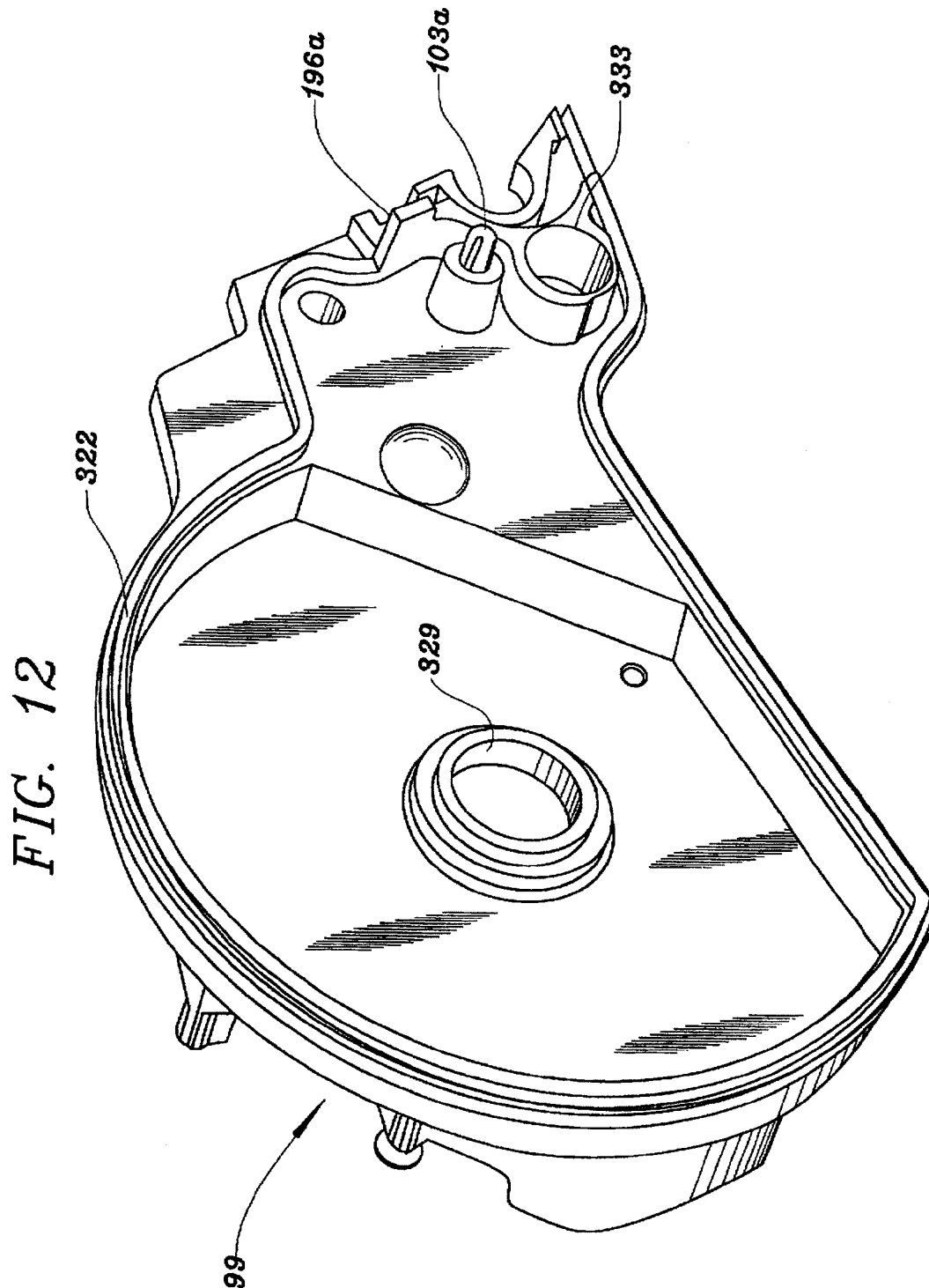


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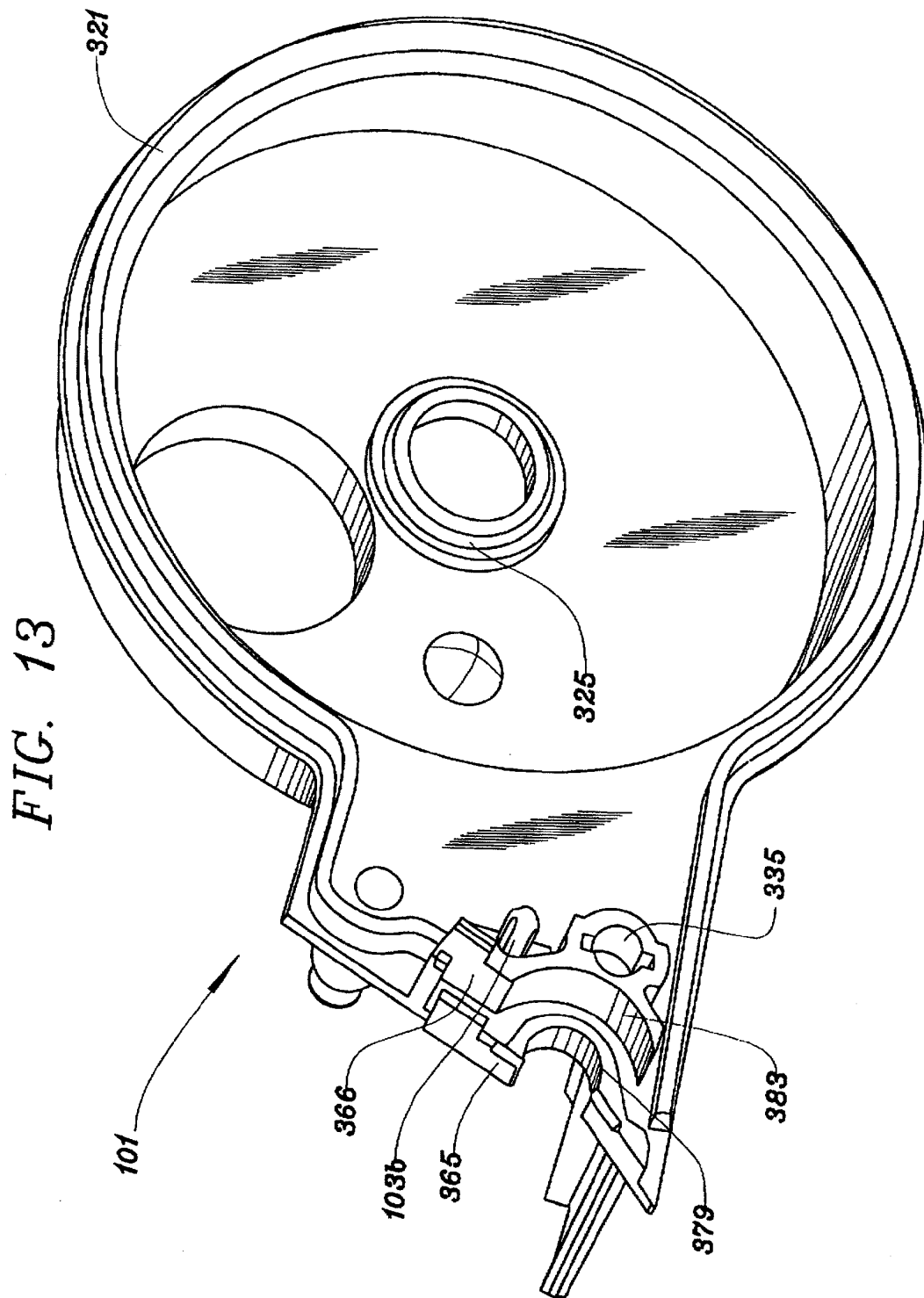


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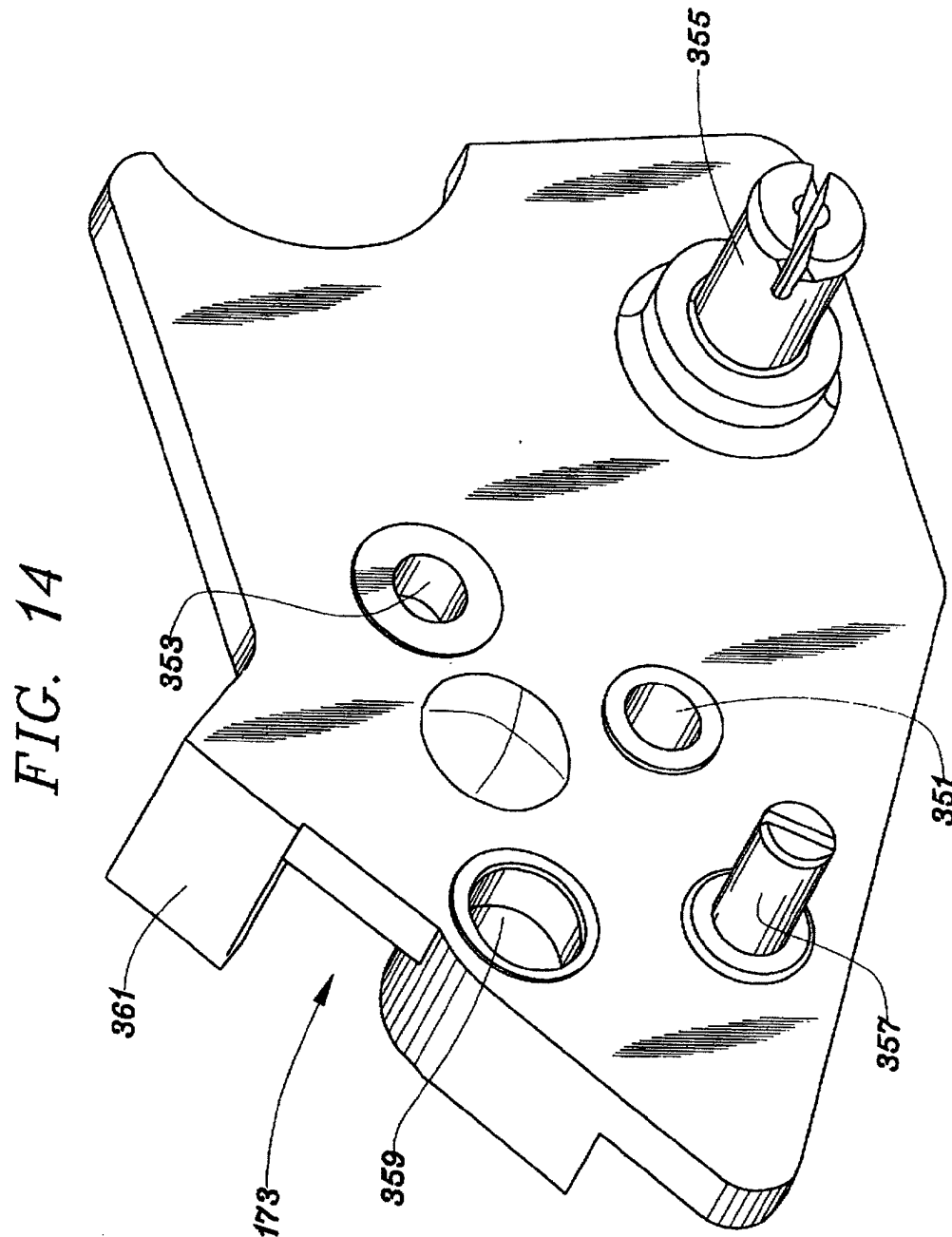


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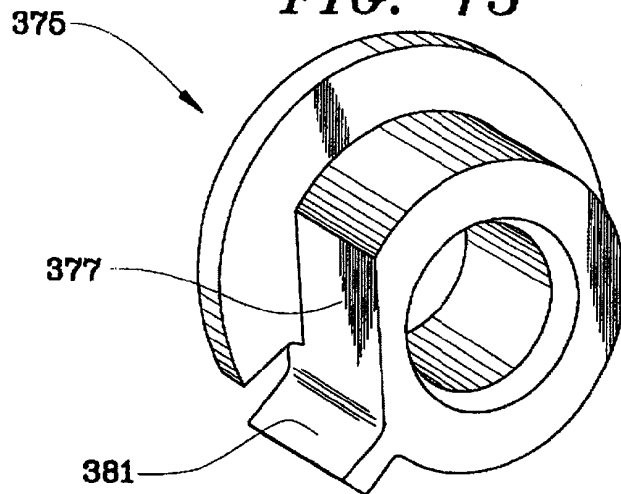
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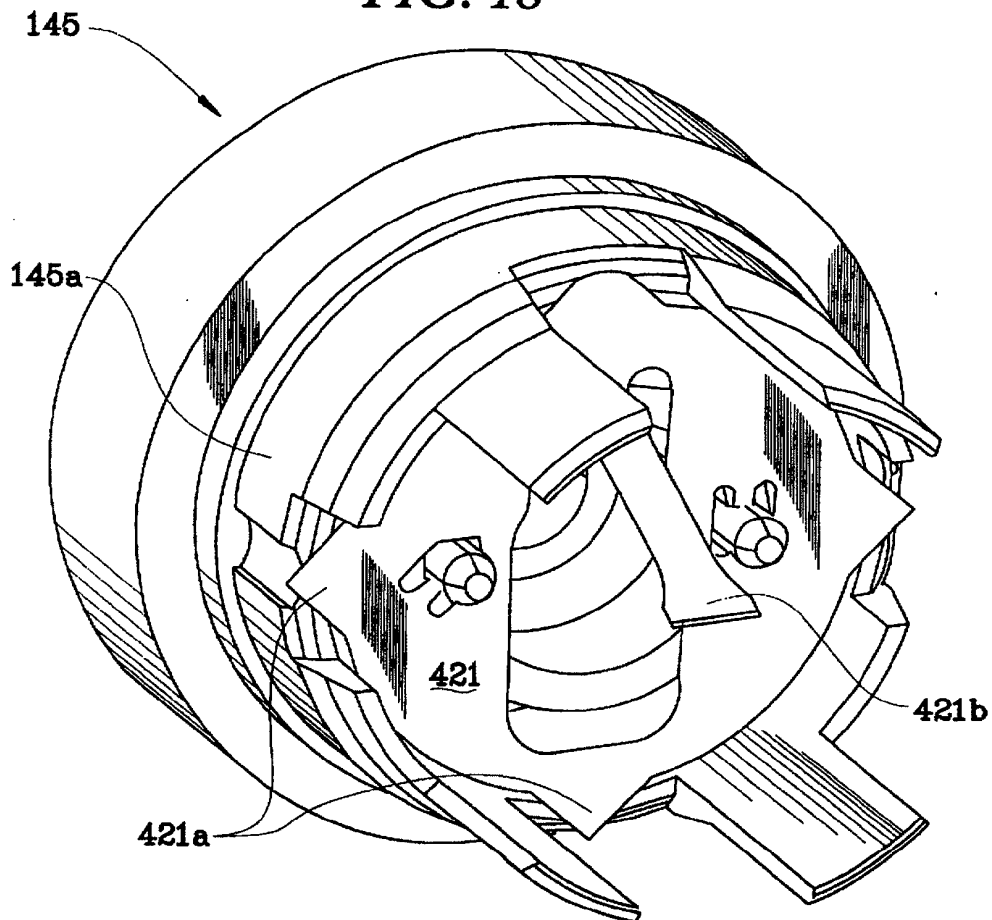
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*FIG. 15*



*FIG. 18*



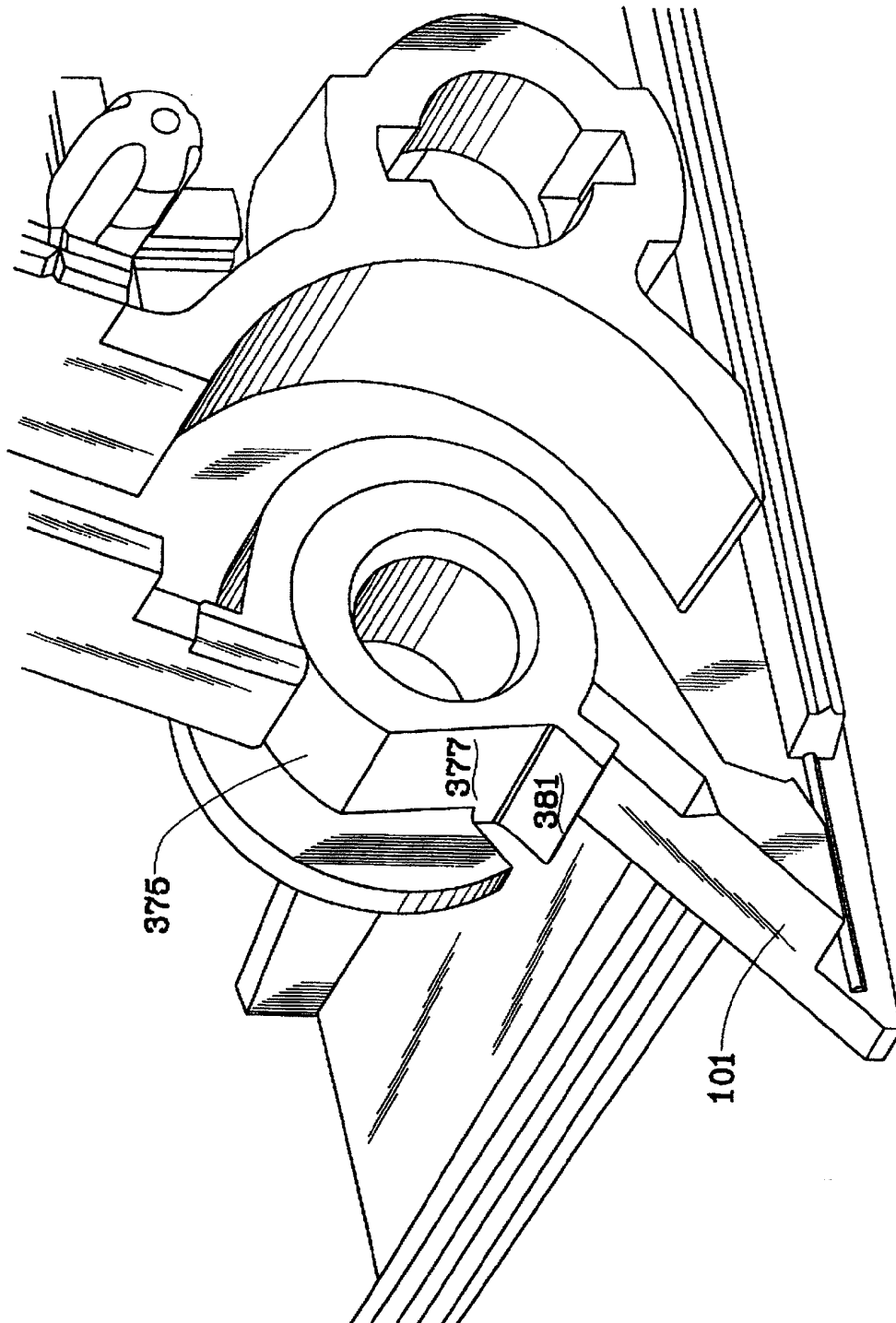
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FIG. 16



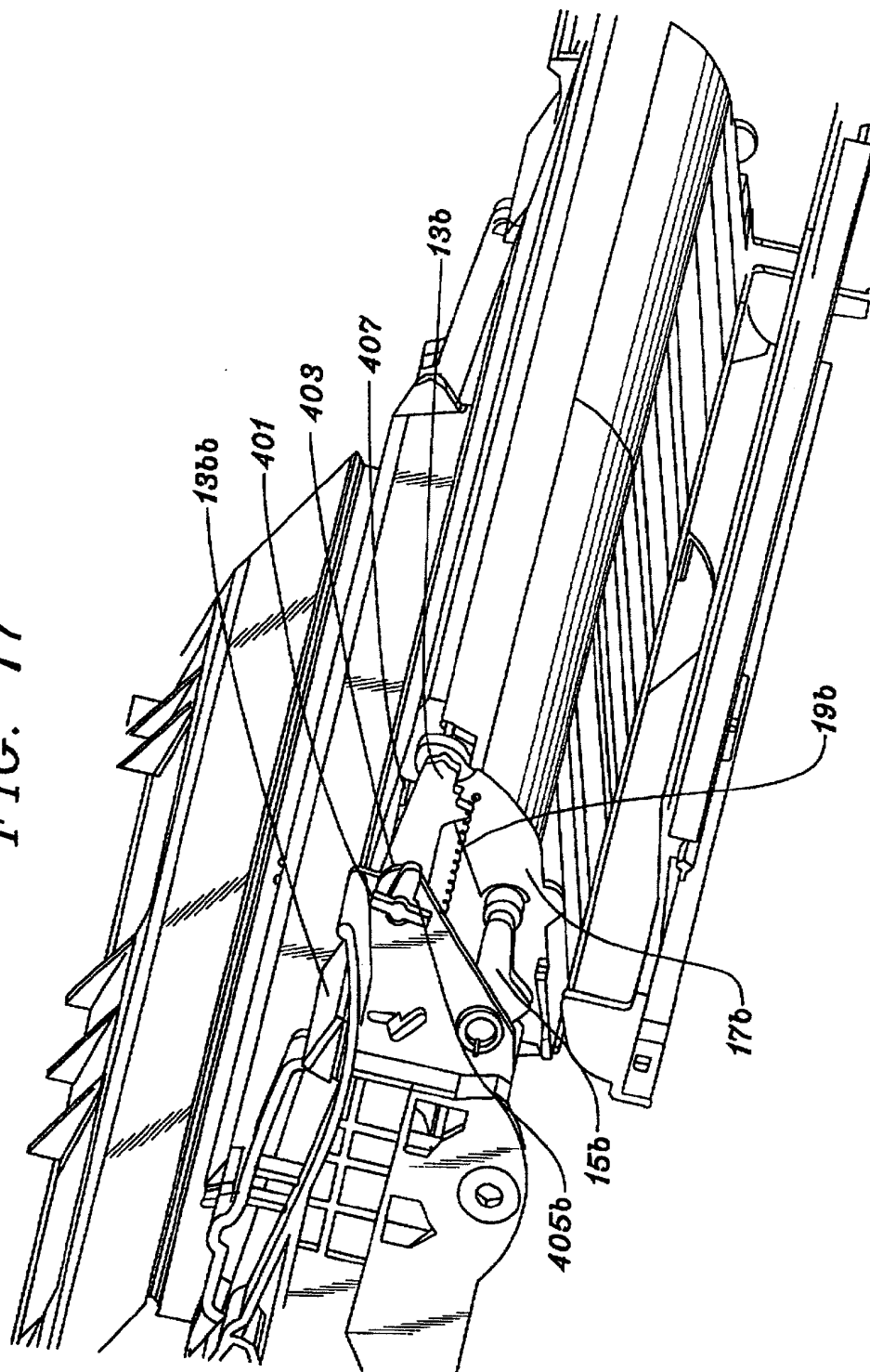
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FIG. 17

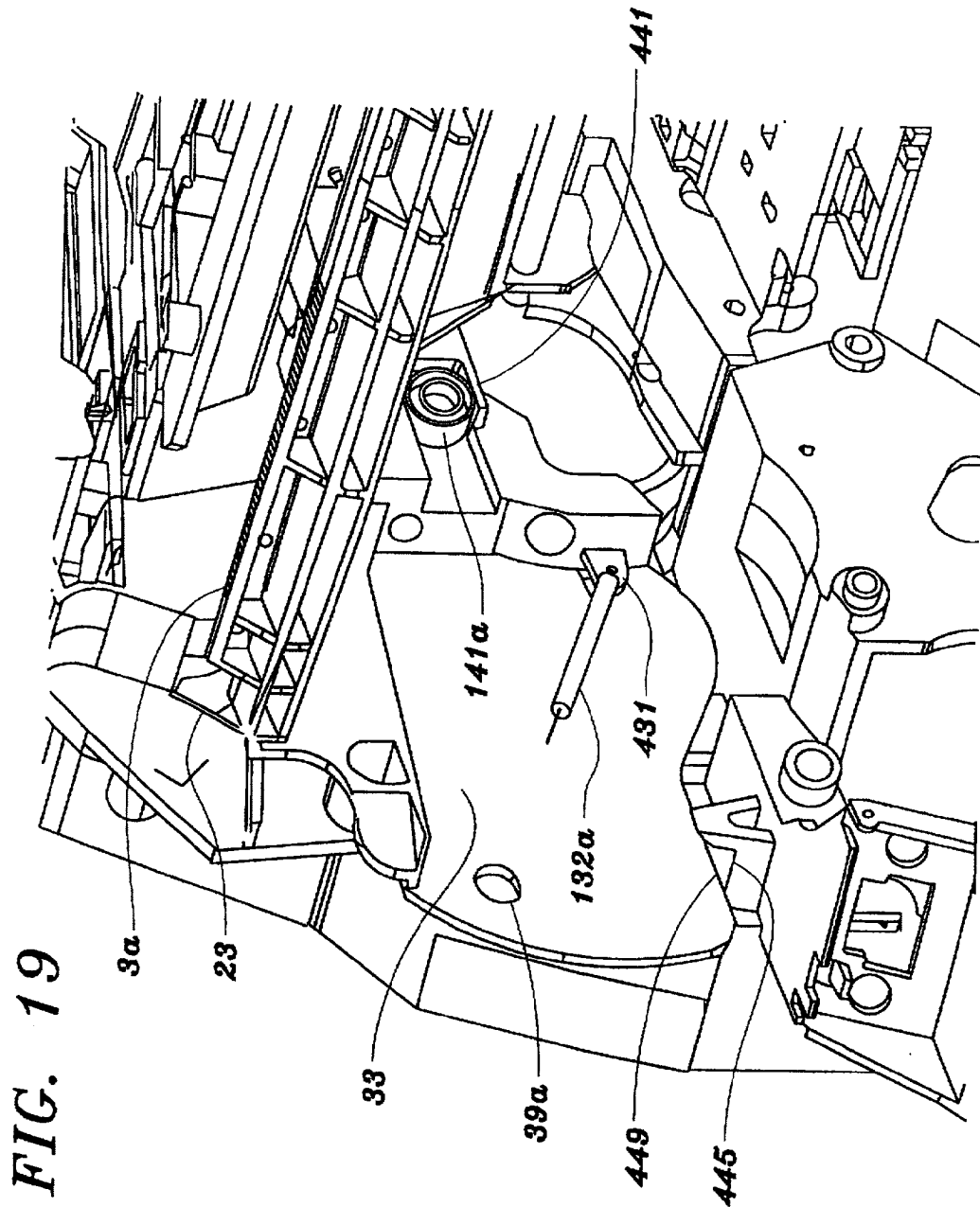


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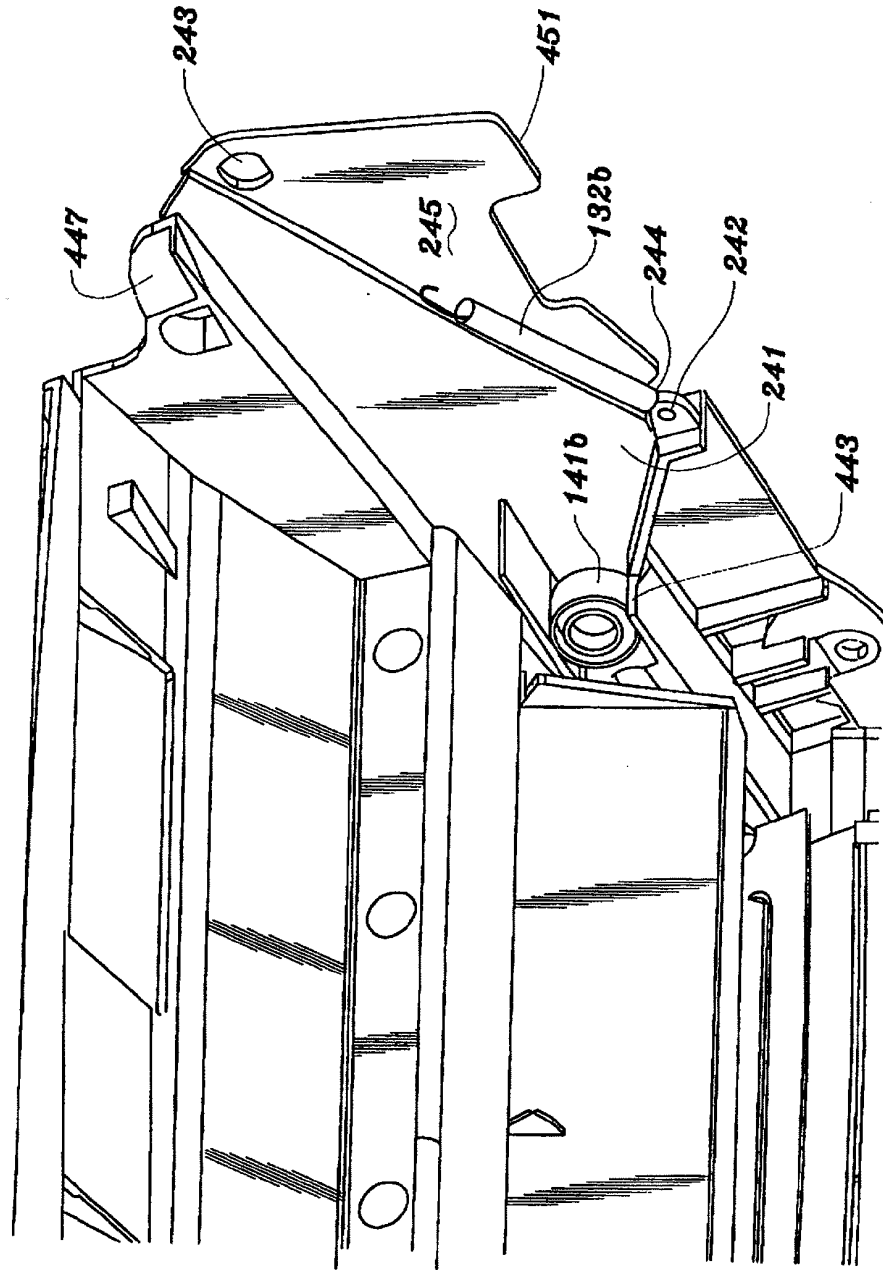
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FIG. 20



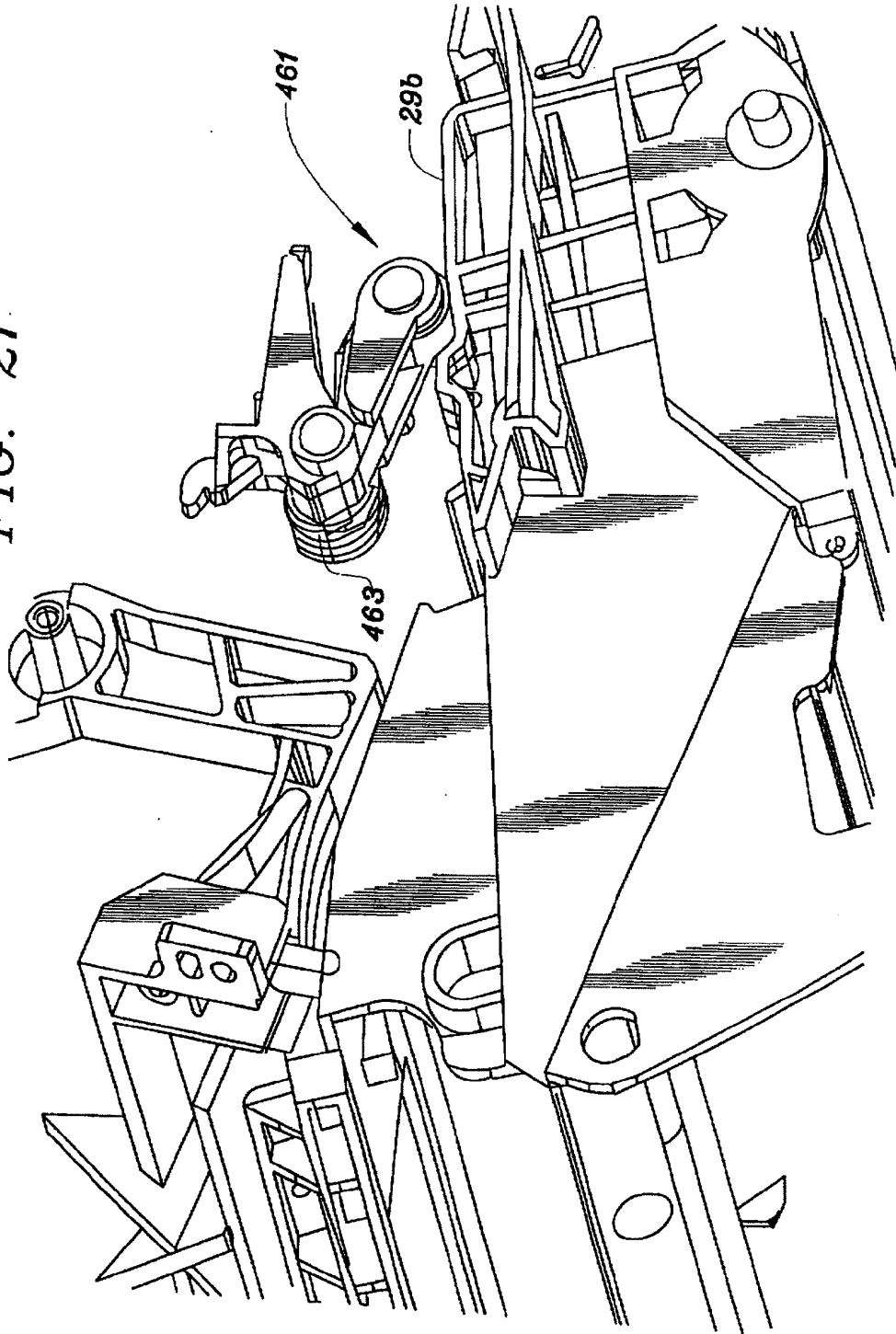
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FIG. 21



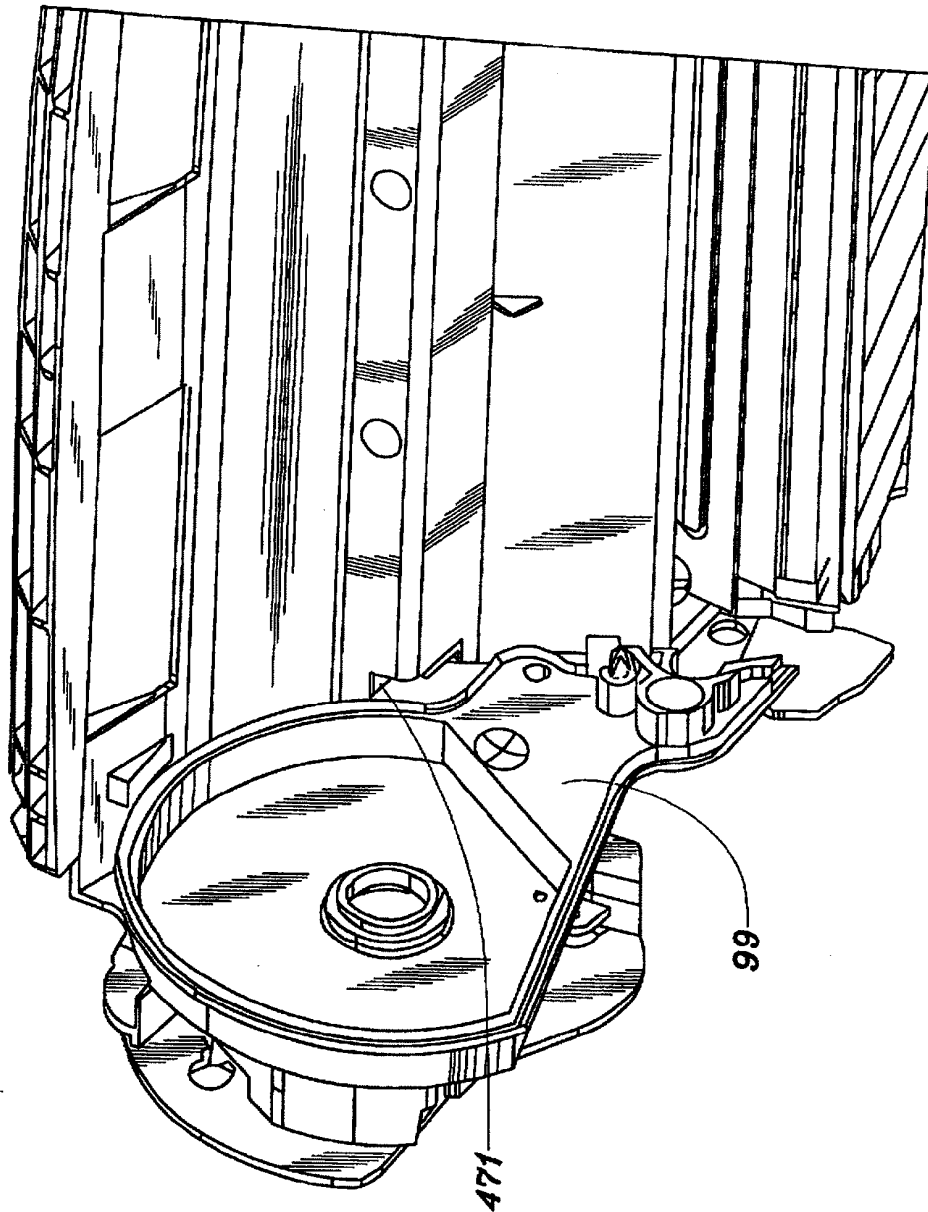
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FIG. 22





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FIG. 23

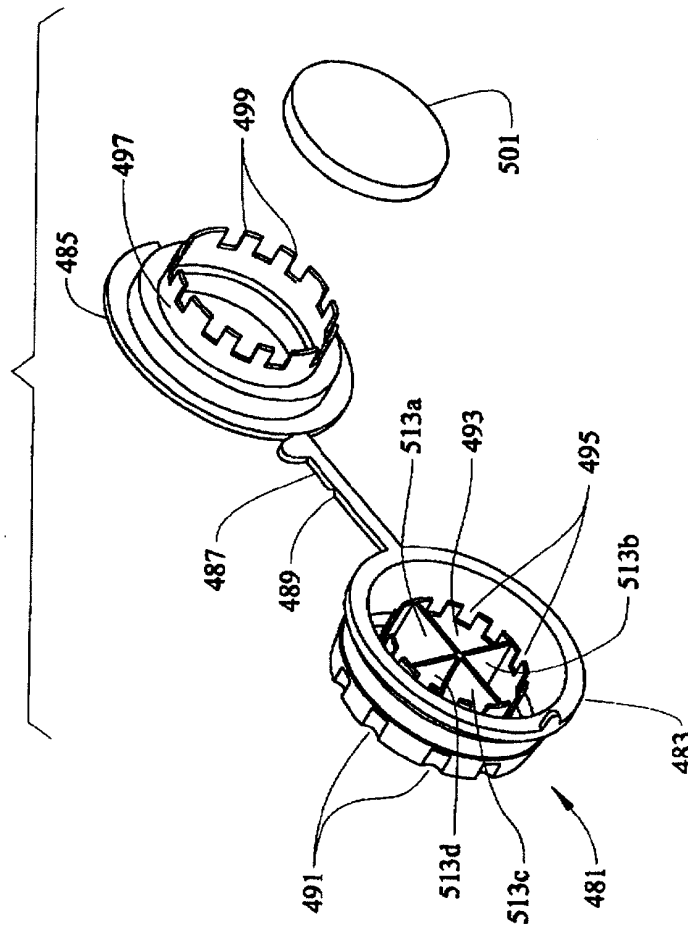
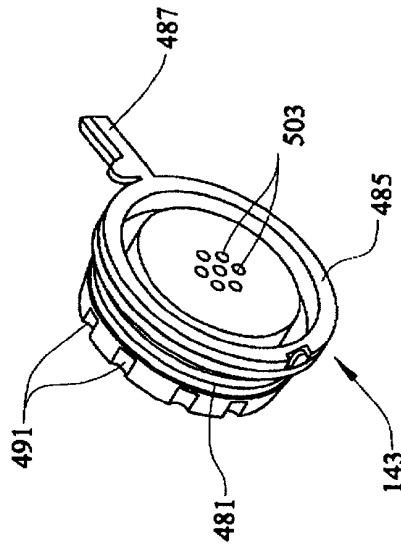


FIG. 24



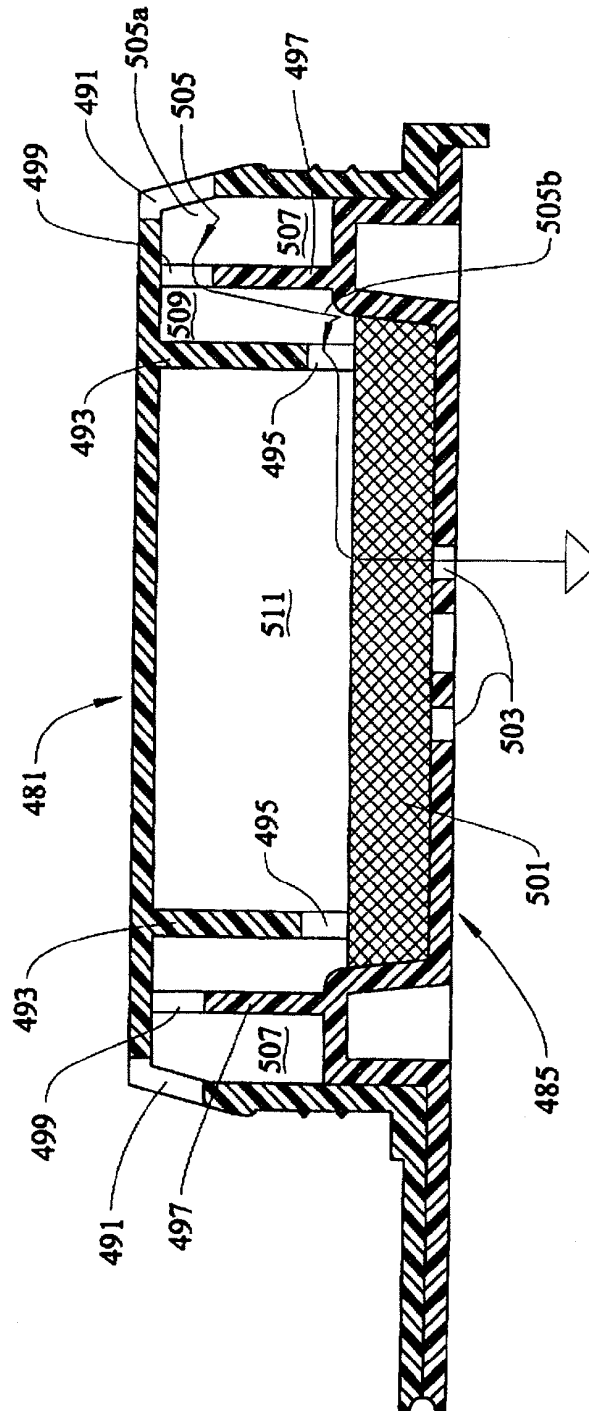
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**FIG. 25**



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## VENTING PLUG IN TONER CARTRIDGE

### CROSS-REFERENCE TO RELATED APPLICATIONS

The following United States patent applications are directed to subject matter disclosed or incorporated in the disclosure of this application Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169 entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device; five utility applications filed the same day as this application entitled "Toner Cartridge with External Planar Installation Guides, Ser. No. 08/770,327;" "Toner Cartridge with Locating on Photoconductor Shaft, Ser. No. 08/770,326;" "Toner Cartridge with Hopper Exit Agitator, Ser. No. 08/770,328;" "Toner Cartridge with Housing and Pin Construction, Ser. No. 08/770,330;" and "Toner Cartridge with Heat Shield Shutter Ser. No. 08/770,334;" and one ornamental design application filed the same day as this application entitled "Toner Cartridge for Laser Printer, Ser. No. 29/066,775."

### TECHNICAL FIELD

This invention relates to electrophotographic development and, more particularly, relates to a plug for a toner cartridge which relieves pressure in the cartridge.

### BACKGROUND OF THE INVENTION

The assignee of this invention has manufactured and sold commercially toner cartridges of two different general designs. For its larger laser printers the cartridge has contained a pump to meter toner of the kind disclosed in U.S. Pat. Nos. 5,012,289 to Aldrich et al. and 5,101,237 to Molloy, while the external structure of the cartridge is as disclosed in U.S. Pat. No. 5,136,333 to Craft et al. Details of other elements in the cartridge have varied. These cartridges have a toner adder roller rotating against the rotating movement of a developer roller, and have experienced internal pressure. Later forms employed an internal channel leading from the developing area to the top area of the cartridge, but not to the outside of the cartridge.

For a smaller, light emitting diode printer, the cartridge is as disclosed in U.S. Pat. No. 5,337,032 to Baker et al., which has a toner hopper extending well below a level having the toner adder roller and which has independent driven systems for the photoconductor roller and for the developer roller system as disclosed in U.S. Pat. No. 5,331,378 to Baker et al. This cartridge also has a toner adder roller rotating against the rotating movement of a developer roller, as does the cartridge disclosed of this invention. That cartridge operated at relatively moderate speed and it had no venting to relieve internal pressure.

Internal pressure can cause toner leaks. The leaks often, but not exclusively, occur immediately after the cartridge becomes inactive. Internal pressure in the hopper is created by ingesting air with toner carried by the developer roller past the lower developer roller seal. The toner adder roller pulls this air/toner mixture away from the developer roller which creates a pressure increase in the hopper until an equilibrium pressure is reached.

This invention is to a plug to outside which allows air to pass while blocking the toner, thus relieving internal pressure while not passing toner through the plug.

### DISCLOSURE OF THE INVENTION

The plug of this invention may be located in a hole in the side of the toner hopper through which the hopper is filled

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with toner. At that location the plug is adjacent the hopper, where pressure tends to increase during operation of the cartridge. To avoid toner leaks from such pressure increases, the plug has multiple walls with multiple, spaced openings, with the plug having a series of outside openings which communicate with the inside of the hopper. Air passing through the outside holes enters a first chamber which is closed immediately in front of the outside holes, but which has opposing second holes on each side. Air passing through these second holes enters a second chamber which is closed immediately in front of the second holes, but has opposing third holes on each side at the opposite end of the second chamber from the second holes. Air passing through the second holes enters a central chamber, the bottom of which has a mat filter which does not pass toner, leading to central holes through the cover.

Preferably, the plug is formed in two mating parts of yieldable plastic which are connected by an aligning feature. The mat filter is inserted in the middle and the two parts are pressed together by a press-fit formed by the outer part being slightly smaller than the inner part.

### BRIEF DESCRIPTION OF THE DRAWING

The details of this invention will be described in connection with the accompanying drawing, in which

FIG. 1 is a perspective view of the toner cartridge from above and left rear, where left is determined facing the printer from its front side where cartridge insertion is made;

FIG. 2 is a perspective view from above and left front of the cartridge sectioned near the top;

FIG. 3 is a top right front view of the cartridge with further cover elements removed;

FIG. 4 is a top right rear view of the cartridge with cover elements removed;

FIG. 5 is a top left rear view of the cartridge with cover elements removed;

FIG. 6 is a top right rear view of the cartridge sectioned similarly to the sectioning of FIG. 2;

FIG. 7 is a bottom left front view of the cartridge;

FIG. 8 is a bottom right rear view of the cartridge;

FIG. 9 is a front right perspective view of the hopper housing member;

FIG. 10 is a left front view of the inside of a printer in which cartridge 1 is installed;

FIG. 11 is a partially sectioned right side view showing more detail of parts shown in FIG. 10 with the cartridge installed;

FIG. 12 is a perspective view showing the inside one end member of the hopper;

FIG. 13 is a perspective view showing the inside of the other end member of the hopper;

FIG. 14 is a perspective view of the gear plate;

FIG. 15 is a perspective view of a readily removable bushing;

FIG. 16 is a perspective view showing the removable bushing installed;

FIG. 17 is a right rear view showing detail of a shutter;

FIG. 18 is a perspective view of an extended hub inserted in the photoconductor drum;

FIG. 19 is a right perspective view showing elements inside the cover of the cartridge;

FIG. 20 is a left bottom perspective view showing elements inside the cover of the cartridge;

FIG. 21 is a right perspective view showing parts of the cartridge installed in a printer; and

FIG. 22 shows the inside of the cover of the cartridge where it receives an extension from the hopper;

FIG. 23 shows elements of the hopper plug prior to assembly;

FIG. 24 shows the assembled hopper plug alone; and

FIG. 25 shows a staggered crosssection of the hopper plug to illustrate air flow.

### BEST MODE FOR CARRYING OUT THE INVENTION

The self-contained, removable printer cartridge 1 is shown in FIG. 1 in a perspective view from above and left rear (the hand grips 3a and 3b being considered the front and the side having the pivoted upper shutter 5 being the upper side).

For purposes of illustration, FIG. 1 shows the upper shutter 5 pivoted downward to its open position and lower shutter 7 pivoted rearward and upward to its open position. In actual operation, these positions are reached by interaction with the printer or other device in which cartridge 1 is installed as will be explained below.

To facilitate and guide insertion of cartridge 1 into the printer, cartridge 1 has a left guide wing 9a and a right guide wing 9b. Guide wings 9a and 9b are thin planes formed as arcs of a relatively large circle, except near the front, where the bottom 9aa is enlarged downward. Guide wings 9a and 9b are mirror images of each other except that, in this particular embodiment described, the left guide wing 9a is wider (extends further laterally) than the right guide wing 9b simply to accommodate the width provided by a particular printer in which the exemplar cartridge 1 is to be installed.

In the embodiment herein described, bottom shutter 7 is pivoted from left-rear cover 31a on a left top actuator link arm 11a and from rear cover (not shown) on a right top actuator link arm 11b, located on opposite sides of shutter 7. Each link arm 11a, and 11b is integral with an actuator 13a, and 13b, respectively, each of which has a rectangular actuator surface 13aa and 13bb, respectively, which extends over the respective guide wings 9a, 9b.

A pivoted lower shutter link 15a and a side of the lower shutter 17a, pivoted to lower link 15a and upper actuator link 11a complete a conventional four bar linkage to provide rotation of shutter 7 in response to rotation of actuator 13a. The rear end of coil spring 19a connects to a lower hook 11aa in link arm 11a to bias shutter 7 closed when the cartridge is not inserted in a printer or other device. The front end of coil spring 19a connects to an upper hole 31aa under actuator 13a. A mirror image of these parts (see FIG. 3) exists on the opposite side, the corresponding part of which will be designated by the same number with "b" letters.

When cartridge 1 is installed in the printer, actuator surfaces 13aa and 13bb are pushed downward by the mating surfaces of the printer to the positions above wings 9a, 9b respectively, as shown in FIG. 1.

Cartridge 1 is inserted by a human operator grasping grips 3a, 3b through holes 3aa, 3bb and moving cartridge 1 in the direction of shutter 5 and toward the rear of the printer (291, FIG. 10) in which it is being installed. A series of upwardly extending ribs 21 spaced along the width of cartridge 1 under grips 3a, 3b, except at holes 3aa and 3bb, provide strength while holes 3aa and 3bb provide room for the fingers of a person to grasp grips 3a, 3b. On the left side is a relatively wide, upwardly extending tab 23. In a preferred

combination of the embodiment of the invention described herein and an exemplary printer the top of tab 23 interacts with a physical sensing switch in the printer to detect that a cartridge 1 has been installed.

Front cover 25, on which grips 3a, 3b, ribs 21 and tab 23 are integrally formed, is above a separated toner hopper, as will be described. The top cover of cleaner chamber 27 is rearward of shutter 5.

Immediately inside wings 9a and 9b are raised, elongated locator surfaces 29a, 29b to which pressure is applied by a printer to firmly position the toning mechanisms of cartridge 1 when cartridge 1 is installed. Locator surfaces 29a and 29b, wings 9a and 9b, as well as rear cover 31 under wing 9a, are formed integral with cleaner housing 27. Also integral with these elements is front cover 25, having grips 3a, 3b and an outer cover 33 on the left side and generally coextensive in length with the length of front cover 25. Cover 33 has a U-shaped housing 35 at its top. Housing 35 traps spacer stud 37a as will be explained and an assembly hole 39a near the upper front of cover 33 and a spring-holding hole 39b near the lower front of cover 33.

A coupler 41 receives a drive element from a printer which contains an Oldham coupler to rotatably drive the developer roller 43 (not shown in FIG. 1) and toner adder roller 45 (not shown in FIG. 1). To the rear of coupler 41 is the shaft 47 of photoconductor drum 49 (drum not shown in FIG. 1).

FIG. 2 is a perspective view from above and left front of cartridge 1 sectioned near the top to show internal elements. At the immediate front is a large, cylindrical toner hopper 61, having a paddle 63, which, during operation, is rotated clockwise as seen in FIG. 2. Paddle 63 has an outer toner moving bar 63a, which extends across the width of hopper 61 except for a far left section 63aa which is inset as will be explained. The rear wall 61a of hopper 61 when cartridge 1 is installed for operation in a printer terminates at about one-third of the total height of hopper 61 as a flat surface 61aa (specifically, hopper 61 has a 106 mm diameter and the distance vertically from the lowest point of hopper 61 to the horizontal plane coinciding with the highest point surface 61aa of rear wall 61a is 35.3 mm). The upper surface 61aa of rear wall 61a is thin and flat with a slight downward angle from hopper 61 to facilitate removal of the molded part from its mold. An extension 65a from an agitator bar 65 has a depending tab 65b (see FIG. 9) which rests on upper wall 61aa thereby positioning bar 65 slightly above upper wall 61aa. Extension 65a extends past upper wall 61aa to a location at which bar 63a of paddle 63 encounters extension 65a as it rotates. The surface 61aaa opposite surface 61aa from which toner exits is flat and at approximately 50 degrees from vertical (best seen in FIG. 9) when cartridge 1 is installed for operation in a printer.

Vertical ribs 67 located immediately rearward of rear wall 61a are stiffeners for top wall 69 formed about one-third down from the top of hopper 61. The toner moving bar 63a of paddle 63 is closely adjacent to the sides of hopper 61 except where the top of rear wall 61a and the start of top wall 69 form an opening for toner to be delivered rearward from hopper 61 to the toning mechanisms of cartridge 1. This is best shown in FIG. 9.

In FIG. 2, a small part of developer roller 43 to which coupler 41 is directly attached, is seen past ribs 67. Developer roller 43 is parallel to and in contact with photoconductor drum 49. Cleaner chamber 27 has spaced, vertical internal baffles 71, which are strengthening members, as well as members which limit unbalanced accumulation of



toner in chamber 27. Toner which is not transferred during development is scraped from photoconductor drum 49 by cleaning blade 73, which is mounted to a vertical panel 73a, having a horizontal gusset 73aa to increase strength. As best seen in FIG. 3, panel 73a is mounted to supporting member 75, which has vertical columns 75a (FIG. 2). 75b on opposite sides. Panel 73a is mounted to the vertical columns 75a, 75b by a screw 77a to panel 75a and a screw 77b to panel 75b.

FIG. 3 is a top right side view with further cover elements removed and part of the cleaner removed to illustrate the internal configuration of cartridge 1. A solid, steel-bar doctor blade 91 extends parallel with and in pressure contact with developer roller 43. Blade 91 contacts roller 43 at about 20 degrees from the vertical toward toner adder roller 45. Also shown in FIG. 3 are metal electrical contact 93 to doctor blade 91, metal electrical contact 95 to toner adder roller 45 and metal electrical contact 97 to developer roller 43. The outer ends 93a, 95a, 97a of the contacts bear against metal contacts in the printer when cartridge 1 is installed and thereby make electrical contact to receive electrical potentials from the printer.

The developing system of cartridge 1 is essentially very similar to that of the Optra brand family of printers sold by the assignee of this invention. As in that family of printers, toner adder roller 45 is a conductive sponge material attached to a steel shaft and developer roller 43 is semiconductive material attached to a steel shaft. When cartridge 1 is installed for operation in a printer, cartridge 1 is oriented generally as shown in FIG. 3 and the horizontal plane containing the lowest surface of toner adder roller 45 is 22.6 mm above the lowest point of hopper 61.

Toner adder roller 45 and developer roller 43 are journaled in the rearward extensions 99a and 101a (FIG. 4) of the end members 99 and 101 (FIG. 4) of hopper 61. Agitator 65 has a bent portion 65aa to become parallel to extension 99a where it is pivoted to extension 99a on pin 103a. As paddle 63 rotates, bar 63a contacts extension 65a, thereby rotating agitator 65 around pin 103a upward. Agitator 65 then returns to near rear wall 61a under the force of gravity to dislodge toner, which otherwise tends to accumulate on exit surface 61aaa (see FIG. 9).

FIG. 4 is a top right rear view with cover elements removed showing more fully the end members 99 and 101 of hopper 61 and their extensions 99a and 101a. Integral with end member 101 is spacer stud 37b. Under and to the front of stud 37b is spring mounting post 131b, which mounts one end of spring 132b, the other end of which is mounted on hole 242 (best seen in FIG. 20).

Also integral with end member 101 is perpendicular shield wall 133, which extends downward and rearward to present a barrier to physically protect encoder wheel 135. The bottom portion of wall 133 forms a flat contact surface 133a to receive a locating roller from the printer when cartridge 1 is installed. Encoder wheel 135 is linked to paddle 63 through a paddle gear assembly 163 having a torsional yield member (FIG. 5) so as to provide information as to the amount of toner in hopper 61 to the printer on which cartridge 1 is installed by the sensing of the location of windows 135a. Additionally, other windows 135b provide other information, while wider window 135c provides a home location reference. Light blocking selected labels 136 are located between windows 135b and 135c and block windows of a series of windows 135b to thereby customize information onto wheel 135. The details and operation of encoder wheel 135 are described in U.S. patent application

Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169, entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device" and form no contribution to the invention of this specification.

FIG. 4 also shows electrical contacts 93, 95 and 97 as they are supported by floor 137 which extends perpendicularly from hopper extension 101a. Vertical ribs 139 extend from floor 137 between contacts 93, 95 and 97 to strengthen the floor 137.

Mounting roller 141a is journaled to hopper extension 99a and symmetrical mounting roller 141b is mounted to hopper extension 101a. Rollers 141a and 141b contact inside surfaces of the cover of cartridge 1, as will be described. Surfaces 133a and 161a (FIG. 5) of hopper 61 rests on rollers in the printer as will be further described.

Hopper end member 101 has an opening receiving a closely-fitting, resilient, cylindrical plug 143. Prior to installing plug 143, toner is loaded into hopper 61 through the open hole, then plug 143 seals the hole.

Photoconductor roller 49 has at its right end a transfer roller drive gear 145, which drives a roller in the printer when cartridge 1 is installed in the printer.

FIG. 5 is a top left rear view with cover elements removed showing more fully the outside of members 99 and 99a of hopper 61. Integral with end member 99 is spacer stud 37a. Under and to the front of stud 37a is spring mounting post 131a, which mounts one end of spring 132a, the other end of which is mounted in a hole in member 431 (FIG. 19), which is an inner extension of cover 33 (FIG. 2).

Also integral with end member 99 is perpendicular shield wall 161, which extends downward and rearward to a barrier to physically protect torsional paddle gear assembly 163. The bottom portion of wall 161 forms a flat contact surface 161a to receive a locating roller from the printer when cartridge 1 is installed. The details of paddle gear assembly 163 are not part of this invention and are more fully disclosed in the above-mentioned patent application Ser. No. 08/602,648, now U.S. Pat. No. 5,634,169.

Gear 49a, integral with the end of photoconductor drum 49, receives power from a meshing gear in the printer when cartridge 1 is installed in the printer. Coupler 41 is integral with developer roller 43 and drives idler gear 165, which drives toner adder roller 45 (FIG. 3) by being meshed with gear 167, which is integral with toner adder roller 45. Coupler 41 receives power from a driver in the printer which is separate from the drive to drum 49, although preferably from a single motor in the printer.

Gear 167 drives the large gear of compound gear 169. Gear 169 drives the large gear of compound gear 171, and gear 171 drives paddle gear 163. A gear plate 173, mounting gears 165 and 169, is mounted on hopper extension 99a by mounting screw 175.

FIG. 5 shows the end of agitator 65 opposite that shown in FIG. 3. That end has a bent portion 65bb to become parallel to extension 101a of end member 101 when it is pivoted to extension 101a on a pin 103b.

Continuing the detailed description of the cartridge incorporating a preferred embodiment of the present invention, FIG. 6 is a top right rear view sectioned near the top similar to the sectioning of FIG. 2. FIG. 6 illustrates more clearly the mounting of doctor blade 91 mounted to press on developer roller 43 under the bias of leaf spring 191. Blade 91 is located on the left rear by tab 361 (best seen in FIG. 14), and on the rear by extension 196a (FIG. 12) of hopper end

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member 99 which form front and back barriers for holding the left side of doctor blade 91. Similarly, on the right side, two surfaces from 101a, including a rear extension 365 (best seen in FIG. 13) and a front extension 366 (FIG. 13) form front and back holding the right side of doctor blade 91, symmetric to the cage holding the left side of doctor blade 91. The top of blade 91 is held by spring 191. An adhesive tape 192 across the top of the doctor blade 91 bridges over the adjoining horizontal edge of wall 69 (FIG. 2) for sealing, as is conventional.

Spring 191 has blunt ends 191 a and 191 b, spaced from the center, which contact blade 91 to bias it downward on to developer roller 43. A central ledge 197, integral with ribs 67, forms a cavity receiving the center of spring 191. Horizontal ledges 199a and 199b, opposite central parts of spring 191, formed integral with ribs 67, are horizontal barriers to prevent spring 191 from moving toward the front. Preferably, so as to permit rough handling of cartridge 1 which might occur during shipment, solid upper stop members (not shown) are attached by double sided adhesive on each side between ledges 199a and 199b and the sides 99a and 101a, respectively. These are spaced 0.18 mm above the top of blade 91 and, therefore, contact blade 91 only during rough handling.

FIG. 6 also illustrates posts 141aa and 141bb, which are molded as extensions of members 99a and 101a, respectively, and supporting mounting rollers 141a and 141b, respectively (FIG. 5).

FIG. 7 is a bottom left front depiction of cartridge 1 viewed externally. A series of horizontal depressions 221 along the back of hopper 61 provide a roughened surface for thumbs when fingers grasp the cartridge through opening 3aa and 3bb. A series of relatively long vertical ribs 223 integral with the bottom of hopper 61 serve as paper and other media guides, while a series of shorter ribs 225, located rearward of the start of ribs 223 and between ribs 223, prevent media snags as media encounter photoconductor drum 49, located immediately after ribs 223 and 225. Past drum 49, media encounter further media guide ribs 227 located on the bottom of shutter 7. FIG. 7 also affords a clear view of idler gear 165 and gear 167.

FIG. 8 is a bottom right rear depiction of cartridge 1 viewed externally. This shows the full right guide wing 9b with enlarged front part 9bb. FIG. 8 shows the right cover elements which were deleted in FIG. 6. A front lower cover section 241 is over much of the encoder wheel 135 and has an access hole 243 for ease of assembly and has an access opening 244 (best seen in FIG. 20). Cover section 241 is stepped outward a small amount to provide room for spring 132b (FIG. 20) to extend between post 131b (FIG. 4) and hole 242 (best seen in FIG. 20). Generally, above and forward of and integral with cover section 241 is cover section 245, which is over the remaining upper front of cartridge 1. Section 245 has a U-shaped housing 247 at its top which traps spacer stud 37b. In the rearward part of section 245 opposite the area above photoconductor drum 49, are located rectangular channels 249 with the second rectangular channel 249a and the last rectangular channel 249b being open to pass air for cooling photoconductor drum 49 during operation of cartridge 1.

The far rear portion 251 of this particular embodiment of the invention herein described mounts links 11b and 17b to shutter 7. A bottom section 253 of the cover located under and forward of passages 249a and 249b mounts the shaft 47 of photoconductor drum 49 and has two upper symmetrical vent holes 255a and 255b to pass air for cooling drum 49.

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FIG. 9 is a front right perspective view of the molded plastic member housing 271 which forms the central portion and central extension of hopper 61 with end member 99 attached and agitator 65 installed. It is seen to form a cylindrical chamber with an exit opening formed between wall 69 and wall 61a. An inset 273 at the bottom rear of hopper 61 provides space for rollers in the printer. As best seen in FIG. 2, paddle bar 63a has an inset far left section 63aa to clear inset 273.

Member 271 has a slot 275 around its right side. A directly similar slot is around the left side. End member 101 has a mating ridge 321 (FIG. 13). During manufacture slot 275 is mated with ridge 321 in end member 101 and the two are welded together with ultrasonically created heat. Member 99 is welded to the left side of member 271 in the same manner with ridge 322 (FIG. 12) inserted in a mating slot (not shown) on the left side of member 271.

A notch 277 above agitator extension 65a allows for sufficient rotation of agitator 65 to allow paddle arm 63a to pass beyond extension 65a while preventing a full turn-over of agitator 65.

#### Developer Assembly

The housing 271 and its attached end members 99 and 101, form toner hopper 61. Extension 101a journals toner adder roller 45 and developer roller 43. Gear plate 173, which is attached to extension 99a by screw 175, journals the opposite ends of toner adder roller 45 and developer roller 43. Accordingly, a single unitary assembly is formed of the hopper 61 rearward to and including developer roller 43.

#### Photoconductor and Cover Assembly

Front cover 25 grips 3a, 3b, left outer cover 33, rear wall 31, (FIG. 1) right cover sections 241, 245, and 251, (FIG. 8) wings 9a, 9b and cleaning chamber 27 are a single molded part. Photoconductor 49 is journaled in this part with its shaft 47 extending past the covers on opposite sides. Shutter 7 is movably supported to left cover 31 and right rear cover 251. Accordingly, a single unitary assembly is formed of the cover members, the photoconductor drum 49 and the shutter 7.

In use, springs 132a and 132b pull the developer roller 43 against the photoconductor drum 49 at a predetermined tension. When cartridge 1 is picked up, the developer assembly and the photoconductor and cover assembly rotate under gravity until stud 37a (FIG. 1) contacts housing 35 and stud 37b (FIG. 8) contacts housing 247, thereby holding the two assemblies together.

#### Lower Shutter as Heat Barrier

Lower shutter 7, when open, covers all of the lower surface of the cleaner chamber. The material of shutter 7 is polycarbonate, a material which deflects heat from the fixing operation which occurs after paper is moved rearward from contact with the photoconductive drum 49. The material of the body of the photoconductor and cover assembly, the hopper 61, end members 99 and 101, and shutter 5 are polystyrene which is lower in cost than polycarbonate would be. The added cost of shutter 7 being polycarbonate is justified by shutter 7 providing heat protection to the cleaner 27 which allows that member to be polystyrene.

#### Agitator Bar System

The toner of cartridge 1 is monocomponent, which can become stagnant and cohesive when left undisturbed for a

time. This stagnation and settling of toner may be aggravated by the slight vibrations generated by the printer motor and gear train in a laser printer.

Failure to deliver toner from wall 61a via sloped exit surface 61aaa is the consequence of the settling, stagnation, and cohesive nature of the monocomponent toner in hopper 61. The angle of repose of the settled toner (i.e., the angle of tilt of a surface on which the settled toner rests before it "falls" under its own weight) can reach or exceed 90 degrees. The exiting surface 61aaa is tilted upward at approximately 50 degrees from vertical during operation (angle A, FIG. 9), allowing the toner to stagnate into a pile that does not reach the toner adder roller 45. This leads to premature failure to print, termed "starvation," as would result using an empty cartridge. Experimentally, as much as 230 grams of the 465 gram capacity of hopper 61 of toner have been found in the hopper 61 of a cartridge 1 when starvation has occurred due to existence of a stagnant pile of toner preventing toner delivery to toner adder roller 45.

Agitator bar 65 overcomes toner stagnation and failure to deliver toner to toner adder roller 45. The primary function of agitator bar 65 is to prevent toner stagnation and to deliver toner from the entrance of the developer sump to the toner adder roller thus preventing premature failure to print.

As the hopper paddle 63 rotates counter-clockwise (FIG. 3), it reaches a point in its rotation where it begins to contact extension 65a and lift agitator bar 65. Paddle 63 continues to lift agitator bar 65 until it loses engagement with extension 65a. At this point, the agitator bar 65 falls back via gravity to the resting position, carrying toner from the entry of the developer chamber to the toner adder roller. (Although not useful on the disclosed embodiment, an alternative is a pad on extension 65a or on upper wall 61aa which will cushion the fall. Such a pad would also serve as a spacer to control the position of the agitator in the down position and eliminate tab 65b).

At the top of its travel the agitator bar 65 is out of the way of the main sump paddle 63 and approaches a notch 277 in the hopper housing 271 (FIG. 9). Notch 277 provides space for the agitator bar 65 to clear the end of hopper paddle 63, and prevents overtravel of the agitator arm 65, which could cause locking into an up position when the cartridge is shipped, stored, or handled outside of the machine.

In the up position, the agitator bar 65 forms a nearly vertical wall over hopper wall 61a. The initial opening above wall 61a is about 26.7 mm, while the height of bar 65 facing that opening is 7 mm. This allows room for toner from the main sump to flow between the agitator 65 and sloped wall 61aaa. It also serves as a temporary barrier to prevent the delivery of excessive amounts of toner from the hopper 61 to the toner adder roller 45. As the agitator bar 65 falls to its resting position, both newly delivered toner and any stagnant toner resting on wall 61aaa are pushed toward the toner adder roll 45. The motion of the agitator 65 also stirs toner in the area above and toward developer roll to doctor blade nip 91, helping to prevent packing and stagnation of toner in this volume.

The agitator 65, preferably can be implemented by stamping (or laser cutting) and can be formed from sheet metal with spring characteristics that maintain agitator shape during assembly and operation. The entire part comprising bar 65, extension 65a and bent portions 65aa and 65bb preferably can be made by stamping out all features in one operation. As envisioned for the preferred embodiment, illustrated herein, bar 65 may have a length approximately equal to the toner adder roller length, which may be, for

example, 220 mm; and have an exemplary height of approximately 7 mm; a thickness of 1.3 mm, chosen to give an agitator mass of the entire part stamped of, for example, approximately 20 grams. Since agitator bar 65 is driven by gravity, the mass is chosen to provide a driving force sufficient to push stagnant toner along wall 61aaa to toner adding roll 45, but the mass is limited so as not to affect the torque sensing function of the hopper paddle 63.

Hinge segments 65aa and 65bb and the associated distance from pins 103a and 103b to agitator bar 65 determine the arc swept by bar 65 as it falls from the up position to the down position. In the present preferred embodiment, pivot distance of 13.5 mm, for example, allows the paddle to sweep from an up position which leaves a gap of 3 mm between the bottom of the bar 65 and the wall 61aa, to a down position 3 mm above the toner adder roller 45. With this design, the weight of the paddle is effectively applied to move toner over the distance swept by the arc. A shorter pivot distance would result in insufficient travel to capture and deliver toner; and would require a heavier paddle to exert the same force on the toner over the distance swept through the arc. Pins 103a and 103b are smaller in diameter (1 mm, for example) than their holes in which they fit in portions 65aa and 65bb to prevent binding due to toner buildup.

Extension 65a is long enough to engage the active segment of paddle 63. Additionally, the length of extension 65a is long enough to overlap the active segment of paddle 63 when extension 65a first engages the paddle 63 to prevent scraping of the paddle surface. A small radius (0.5 mm, for example) is placed on the bottom tip of extension 65a to prevent scraping of paddle 63 as it releases extension 65a.

The overall length and elasticity of the agitator 65 allows assembly over pins 103a and 103b by simply deflecting the part.

Accordingly, this agitator design functions to overcome toner stagnation and to deliver toner from the entry of the hopper 61 to the toner adder roller 45 active area. The agitator 65 and its extensions 65a, 65aa and 65bb are a single part. Agitator bar 65 is driven internally, with no external gearing, cams, or seals as would be required by an externally driven agitator. Thus gear cost and complexity, seals, friction, and toner leaks are eliminated as problem areas. Agitator 65 is activated frequently enough to move toner and prevent stagnation without adding excessive stirring or damage to the toner. This design enhances first-in, first-out toner delivery from hopper 61 to the smaller area containing the toner adder roller 45 by preventing excessive toner delivery in the raised position and discouraging return toner from the area of the toner adder roller 45 to the hopper 61.

#### Dimensions

With the cartridge installed for operation, the location of the nip of toner adder roller 45 with developer roller 43 is at 105 degrees from vertical. The nip angle of the photoconductor drum 49 to the developer roller 43 is 95 degrees from vertical. As previously stated, the doctor blade nip is at 20 degrees from the vertical.

The length from the bottom of hopper 61 to the horizontal plane coinciding with the edge of top surface 69 near hopper 61 is 61.96 mm, creating an initial opening of about 26.7 mm (as indicated previously, bottom surface 61aa is at 35.3 mm). Top surface 69 has a slight upward angle to a tallest point of 64.34 mm.

The diameter of toner adder roller 45 is 14 mm and it is located with its circumference 1 mm above the bottom of



hopper body 271 immediately below it. The diameter of developer roller 43 is 20.11 mm and it is located with its circumference 2 mm above the bottom of hopper body 271 immediately below it. The length from the bottom of hopper 61 to the horizontal plane coinciding with the bottom of developer roller 43 is 23.7 mm, and the corresponding length to the bottom of the toner adder roller 45 is 22.6 mm. The diameter of photoconductor drum 49 is 30 mm.

The bottom of body 271 under rollers 43 and 45 is at a 6 degree upward angle to provide sufficient room for guide ribs 225 on the outside of body 271.

#### Installing the Cartridge

FIG. 10 is a left front view of the inside of a printer with which the inventive cartridge herein described by way of an exemplary preferred embodiment may be used. The cartridge 1 is installed in a printer 291 (FIG. 10) from the front to a final position well within the printer 291. To achieve this, guide wings 9a and 9b are initially guided by a lower track 293 over a curved track, which guides cartridge 1 under the laser printhead (not shown) and over paper feed elements 295.

The path is downward, which utilizes gravity while inserting cartridge 1, thereby easing insertion. The guide 293 (and a guide not shown, which is a mirror image of guide 293 on the opposite side of printer 291) has the same curvature as wings 9a, 9b so that the wings 9a, 9b can follow guide 293 and its opposite guide.

Upper guide 297 is parallel to guide 293. Guide 297 extends further into the printer than guide 293. A guide (not shown), which is a mirror image of guide 297, is on the opposite side of printer 291. Guide 297 encounters actuator surface 13bb early during the insertion of cartridge 1. As cartridge 1 is moved rearward, actuator surface 13bb is rotated to open shutter 7 (as is surface 13aa rotated by encountering a mirror image of guide 297 on the left side of the printer). This early movement of shutter 7 is very advantageous in that it eliminates the need for space and mechanism which would be required if actuation occurred at the end of insertion of cartridge 1.

Also shown in FIG. 10 is the right reference position roller 299 on which contact surface 133a rests when the cartridge is inserted. Contact surface 161a will rest on an identical roller (not shown) on the opposite side of printer 291. Rearward of roller 299 is V-block 301, shown more clearly in FIG. 11, and an associated electrical contact 302. Further rearward is an upstanding lug 303, which will contact shutter 7 to hold it open as will be described.

As cartridge 1 is inserted, wings 9a, 9b are guided by guides 293 and 297 and the mirror image guide (not shown) on the opposite side of printer 291. As insertion continues, the wings 9a, 9b fall off the lower guide 293 (and its mirror image guide) and the shaft 47 of photoconductor drum 49 drops into V-block 301 and a mirror image V-block (not shown) on the opposite side of printer 291. A depending thin metal sheet 302 (FIG. 11, shown in side view) is contacted and bent somewhat by shaft 47 as it is guided by V-block 301. This creates a connection for operating potential to shaft 47. When cartridge 1 falls into V-block 301, lug 303 contacts shutter 7 to hold shutter 7 open. Prior to that the longer length of upper guide 297 was sufficient to hold shutter 7 open.

In this final position cartridge 1 is more precisely located with respect to functional elements. Cartridge 1 is held in printer 291 as described below under the heading "Reference Surfaces."

To remove the cartridge, it is grasped by grips 3a, 3b and pulled sharply upward and forward. Wings 9a and 9b again enter between guides 293 and 297, and the cartridge can be pulled free.

#### Manufacture of Cartridge

All molded parts follow the technical dictate (to avoid distortion on cooling) of keeping adjoining surfaces the same thickness. Accordingly, molded studs seen from the rear (shown, for example, in FIG. 13) appear as holes in the part. Circles in the drawings with bowed lines crossing indicate the gate where molten resin was received into the mold (shown, for example, also in FIG. 13).

Assembly of cartridge 1 begins with the joining of hopper body 271 to its end members 99 and 101 with paddle 63 installed. The inside of end member 99 is shown in FIG. 12 and the inside of member 101 is shown in FIG. 13. Both are molded parts of polystyrene resin. Each of the members 99 and 101 is mated to its corresponding side of body 271 (FIG. 9). Ridge 321 of member 101 enters slot 275 on the right edge of member 271. Ridge 322 of member 99 enters slot (not shown) on the left edge of member 271 mating ridge 322. Those parts are held tightly in a fixture and ultrasonically welded, with paddle 63 inserted before the last of the two end members is welded. Then a bushing (not shown) is press fit into the central hole 325 of member 101 around the shaft of paddle 63 and a second bushing (not shown) is similarly press fit around the shaft of paddle 63 in central hole 329.

Agitator bar 65 (FIG. 9) is then flexed and installed by mounting end portion 65aa on pin 103a and end portion 65bb on pin 103b.

Toner adder roller 45 with low friction washers on each end is then installed by angling its shaft through hole 333 (FIG. 12) in member 99, straightening, and then moving roller 45 laterally to bring its shaft through a press fit bushing (not shown) in hole 335 in member 101.

Prior to installing toner adder roller 45 and gear plate 173, a sickle-shaped seal member having a semicircular central body (not shown) is installed on each side of the location of developer roller 43. Such a seal is illustrated in IBM Technical Disclosure Bulletin, Vol. 33, No. 3B, August 1990, pp. 29-30, entitled "Toner Seal for Printer." The location of this seal on the right side is labeled surface 383 in FIG. 13. This is essentially standard as putty is first applied on each end of the location for the seal and the ends of the compliant elongated seal are pressed into the putty. The seal has ridges directed slightly toward the center. A seal system such as this is essentially the same as previous cartridges.

Doctor blade 91 (best seen in FIG. 6) is then installed by bringing it vertically upward behind ridge 365 (FIG. 13) on the right. In the completed cartridge 1 blade 91 is held on the bottom by contact with developer roller 43. Developer roller 43 with low friction washers on each end is installed by positioning the left end of its shaft past end member 99 (FIG. 12) and threading the right end of its shaft through the central hole of the bushing 375, shown in FIG. 15.

Gear plate 173 is shown alone in FIG. 14. It has a hole 351 to receive the shaft of toner adder roller 45 and hole 359 for shaft of developer roller 43. A central hole 353 is to receive screw 175 but hole 353 is significantly larger than the shaft of screw 175. Gear plate 173 has a shaft 355, a shaft 357, and a rightwardly extending tab 361.

Gear plate 173 is brought toward member 99 while the shafts of toner adder roller 45 and developer roller 43 are

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positioned through holes 351 and hole 359 respectively. Gear plate 173 is rotated until tab 361 abuts the edge of doctor blade 91. This serves as a locator for gear plate 173 and doctor blade 91. Screw 175 is then tightened in hole 353 to fix plate 173 in that position.

Gears 169, 165 and 171 are pressed on shafts 355, 357 and 363 (FIG. 5, on member 99). (As is shown in FIG. 14, such shafts have an enlarged head with a gap so as to be yieldable when receiving a press-on force.) A gear 167 is also pressed on the shaft toner adder roller 45. Paddle gear assembly 163 is pressed onto the shaft of paddle 63. These gears and drive coupler 41 are keyed to their shafts by the two having matching "D" cross sections.

Bushing 375 has a flat outside segment 377 which permits bushing 375 to enter opening 379 (FIG. 13) in member 101 since opening 379 is circular with an open less-than-one-half circle segment in which bushing 375 can fit at one orientation. Bushing 375 is then rotated in a direction to rotate lower tab 381 downward, which removes the orientation at which bushing 375 can fit through the incomplete segment of 379 and locks bushing 375 into place. Bushing 375 installed is shown in FIG. 16. In operation, developer roller 43 rotates in a direction to rotate tab 381 downward. The advantage of bushing 375 is that it provides for relatively easy installation and change of developer roller 43 in the event that a member requires replacement during subsequent tests.

Drive coupler 41 is then press fit on the left end of the shaft of developer roller 43 using a locating shim to space coupler 41 slightly from cover 31. Mounting rollers 141a and 141b are previously applied by press fit during completion of the hopper 61. An adhesive tape is applied across the top of doctor blade 91. Spring 191 is then flexed into place to bias doctor blade 91 downward. After toner is installed and leak tested, the previously mentioned upper stop members on each side of ledges 199a and 199b are applied individually and remain in place, held by their back adhesive layer. Also encoder wheel 135 is installed by press fit.

With rollers 43 and 45 and doctor blade 91 in place, metal contact 93 is inserted between ribs 139. Contact 93 has arrowhead sides to bind into ribs 139, and extends upward and over two posts 385 (FIG. 4) in member 101a and extends to a bent end which presses against doctor blade 91. Contacts 95 and 97 similarly have arrowhead sides which dig into ribs 139 and terminate in short bent ends 387, 389, respectively, which press against the shafts of roller 45 and 43, respectively. Contact grease is added to contacts and shafts.

The foregoing all are part of the developer assembly. The photoconductor and cover assembly is separately assembled. The cleaner blade panel 73a (see FIG. 3) is installed using screws 77a and 77b. Link arms 11a, 11b, 17a, 17b and 15a, 15b are assembled in a known manner by studs having extensions which enter matching holes in adjoining arms. The arms are then are rotated to operating positions in which the extensions find no opening and therefore lock the members together while leaving them free to rotate. Links 13a to 11a and 13b to 11b are held by a pin 401 with latch, as shown in FIG. 17.

Pin 401 has a circular flexible arm 403 and latches 11a and 11b have a matching ledge 405b (the ledge on the opposite side not shown). Pin 401 is inserted through the holes of member 13a and 11a and another pin 401 is inserted through the holes of members 13b and 11b. The pins 401 are then rotated until their arms 403 flex around ledge 405b and the ledge on the opposite side, respectively, and then recover

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to latch under ledge 405b and the ledge on the opposite side, respectively. This holds both four bar linkages in place. Pin 401 has a shaft 407 (best seen in FIG. 4), which extends into a groove (not shown) on each side of cleaner 27 for added stability of each four bar linkage.

Shutter 7 is installed by flexing shutter 7 and locating pins 431b (FIG. 1) and a pin on the opposite side (not shown) and inserting pin 431b and the pin on the opposite side in holes in the sides of locator surface 29a, 29b, respectively. Pin 431b has a coil compression spring 433 wrapped around it which is tensioned to bias cover 7 upward.

As best seen in FIG. 19, one end of spring 132a is attached through a hole of connector tab 431 of cover 33 on one side and the opposite end of spring 132a is temporarily attached to hole 39a of cover 33. As seen in FIG. 20, spring 132b is attached through a hole of connector tab 242 of cover 241 on one side and the opposite end of spring 132b is temporarily attached to hole 243 of cover 241.

The photoconductor drum 49 is installed into the cleaner housing assembly by placing the drum and the two gears 49a and 145 (see FIGS. 4 and 5) in position with a thin washer, (not shown) on the left side and inserting shaft 47 through that assembly and the housings 31 (FIG. 2) and 253 (FIG. 8). Standard E-clips are installed on each end of shaft 47 to hold the drum and shaft from lateral movement. As shown in FIG. 18, an extending hub 145a of gear 145, has an internal copper sheet 421 with three sharp points 421a. Copper sheet 421 also has an elongated member 421b extending to over the central hole. Hub 145a is inserted inside drum 49. Points 421a dig into the aluminum cylinder which forms the inside of drum 49, creating both physical and electrical connection. Shaft 47 is then threaded through gear 145, drum 49 and then through gear 49a. This bends elongated member 421b so that it presses against shaft 47 and makes electrical contact.

The developer assembly is then placed before the photoconductor and cover assembly and the two are moved together. Covers 33 and 241, 245 flex outward and then close into the final position. Springs 132a and 132b are removed from holes 39a and 243 and manually attached to studs 131a and 131b respectively. This completes the cartridge 1.

It will be readily understood that any joint where toner is contained must be sealed. Immediately inside the bearings of toner paddle 63 and toner adder roller 45 synthetic rubber end seals are located. FIG. 13 shows a socket 335 having upper and lower tabs which receive such a seal, the seal having matching extensions which fit in the tabs to prevent rotation of the seal. The ends of the chamber of cleaner 27 have foam walls with outer adhesive to secure their positioning. As is previously known, other extended joints have a plastic (polyethylene terephthalate) tape with one side carrying pressure sensitive adhesive applied along them by the adhesive. As is also previously known, developer roller 43 is sealed with a tape which is cantilevered up from the bottom of body 271 to be located in front of the roller 43. A second adhesive strip seals the far rear edge of body 271. Such sealing is basically standard and forms no part of this invention.

#### Toner

In a preferred embodiment cartridge 1 employs mono-component electrophotographic toner which may be basically conventional. The amount of toner in hopper 61 is limited by pressure impairing print quality and sensing of toner level by toner resistance on paddle 63. When cartridge 1 is in the installed position, a typical top level of toner will be 10 mm above the upper barrier wall 61aa. The presence

of toner at that typical highest level is indicated in FIG. 9 by surface lines 425, but the toner is shown otherwise as transparent for clarity. The actual toner is, of course, an opaque, dry powder. During use, the toner is depleted to lower levels and it is moved by paddle 63. As is conventional, developer roller 43 applies toner 425 to photoconductor drum 49 to develop electrostatic images on photoconductor drum 49.

#### Reference Surfaces

FIG. 19 shows just the roller 141a of the hopper assembly as finally installed and, therefore, located on a flat surface 441 which is an extension of the cover 33. Similarly, FIG. 20 shows just the roller 141b of the hopper assembly as finally installed and therefore located on a flat surface 443 which is an extension of cover 241. Such positioning of an assembly with the photoconductor roller and an assembly with the developer roller for lateral adjustment for rollers is essentially the same as in prior cartridges.

However, in the described embodiment of the present cartridge, cartridge 1 has flat surfaces 133a and 161a and the printer 291 has the second set of rollers (roller 299, FIG. 10 and its mirror image), on which flat surfaces 133a and 161a, respectively, rest. In the prior cartridges a second set of rollers was part of the cartridge. As in the prior cartridges the two sets of rollers 141a, 141b, 299, and the mirror roller image of 299, define a plane of movement to guide the developer roller 43 into the intended contact with photoconductor drum 49.

FIG. 19 shows tab 23, which is an extension of cover 33 and, when the cartridge 1 is installed in a printer as shown in FIG. 19, is generally above a flat surface 445 of the frame of the printer. Similarly, as shown in FIG. 20, a top flat ledge 447 is an extension of cover 241 and, when cartridge 1 is installed in a printer, is above a flat surface (448 of FIG. 10) of the frame of the printer.

A flat bottom surface 449 (FIG. 19) is under tab 23 of cover 33, and a flat bottom surface 451 (FIG. 20) of cover 245 is under ledge 447. Bottom surfaces 449 and 451 are locator surfaces which rest on frame surfaces 445 and 448, respectively.

FIG. 21 shows the right side of cartridge 1 installed in a printer with emphasis on cantilevered roller 461 pressing down on locator surface 29b. A second cantilevered roller (not shown), which is a mirror image of roller 461 exists and presses down on locator surface 29a. Roller 461 and its mirror image roller are attached to the frame of the printer. They are firmly biased downward by a coil spring 463 for roller 461 and a mirror image coil spring for the mirror image roller. As the cartridge 1 is inserted in the printer by movement of wing 9a in guides 293, 297 and wing 9b in corresponding mirror image guides, locator surface 29b encounters cantilevered roller 461 and locator surface 29a encounters a corresponding mirror image cantilevered roller; and the locator surfaces 29a, 29b rotate those rollers upward as the cartridge 1 continues to move.

When wing 9a falls off of guide 293 and is finally positioned by shaft 47 settling in V-block 301, cantilevered roller 461 fully contacts surface 29b, as shown in FIG. 21. When the top cover of the printer is closed, a downwardly positioned leaf spring on the printer cover contacts tab 23 on the left front of cover 33 and a second downwardly positioned spring on the printer cover contacts surface 447 on right cover 241. Such interaction of a cartridge with a printer lid is generally conventional, as illustrated by U.S. Pat. No. 5,365,315 to Baker et al.

As the printer lid is closed, a charge roller mechanism is moved to shutter 5 and then continues to move downward to open shutter 5 by pushing it down and to bring a charge

roller in contact with photoconductor 49. A laser beam for discharging drum 49 is also directed through the opening left after shutter 5 is pivoted down, as is shown on U.S. Pat. No. 5,526,097 to Ream.

In summary, the photoconductor and cover assembly is located downwardly by front surfaces 449 and 451, is located downwardly by shaft 47 in V-block 301 and in the mirror image V-block and is held in the downward location by cantilevered roller 461 on surface 29b and the mirror image cantilevered roller on surface 29a. The developer assembly is located laterally by springs 132a and 132b moving the assembly so that developer roller 43 contacts the photoconductor 49, and is located downwardly by ledge 133a resting on roller 299 and ledge 161a resting on the mirror image roller to roller 299. The developer assembly requires no upward locator as it has sufficient weight not to displace upward.

Ledges 133a and 161a resting on roller 299 and a mirror image roller respectively permit the developer assembly to adjust laterally. In prior cartridges, both sets of rollers were in tracks in the cartridge. This required difficult tolerances to locate the bottom of the cartridge within the printer. In the subject cartridge, ledges 133a and 161a have no linked parts to the media guide ribs 223 and 225, which are in the same molded part as ledges 133a and 161a.

FIG. 22 shows an extension of side member 99 held in a slot 471 in the bottom of the cover 25. This provides lateral location between the hopper assembly and the cover 25. Generally similar lateral location structure is in previous cartridges. If desirable, the upper parts of end members 99 and 101 and have an upward ridge or bump, which will strike cover 25 during rough handling and thereby limit relative upward movement of the hopper assembly with respect to cover 25.

When installed in the printer, frame members contact left cover 31 and right cover 241 to assure they do not contact the hopper assembly and interfere with its free movement over roller 299 and its mirror image roller on ledges 133a and 161a respectively.

#### Venting By Plug

Plug 143 (FIG. 24) in a preferred form is a venting element which allows air to escape cartridge 1 while blocking toner. Cartridge 1 in the embodiment disclosed is designed to operate at high speed to print from 8 to 24 or more standard pages per minute. This operation generates a potentially detrimental internal pressure level during operation, which contributes to leaks of toner from cartridge 1. To relieve such pressure, plug 143 is a labyrinth design ending in a felt filter.

The leaks often, but not exclusively, occur immediately after the cartridge becomes inactive. Internal pressure in hopper 61 is created by ingesting air with toner 425 carried by the developer roller 43 past a seal (not shown) under the developer roller 43. The toner adder roller 45 pulls this air/toner mixture away from the developer roller which creates a pressure increase in hopper 61 until an equilibrium pressure is reached. As shown in FIG. 23, plug 143 is formed from a single molded part 481 having a circular base member 483 and a circular cap member 485 separated by a thin connecting arm 487, which has a central notch 489 to permit bending as a solid hinge.

Base 483 has a series of equally separated external holes 491 around the entire bottom circumference of base 483. Extending from the bottom of base 483 and located inward is a circular wall 493 having spaced rectangular openings 495 at the outer end of wall 493 equally spaced around the entire circumference of wall 493.

Similarly, cap 485 has a circular wall 497 extending from the top of cap 485 having spaced rectangular openings 499



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at the outer end of wall 497 equally spaced around the entire circumference of wall 497. A disk 501 of standard F3 felt is pressed into the center of cap 485 where it contacts the inside of holes 503 (FIG. 24) in the center of cap 485.

To complete plug 143 as shown in FIG. 24, cap 485 and base 483 are intermeshed by folding arm 487 at hinge point 489. In this position no part of openings 499 is opposite external holes 491 and no part of openings 495 is opposite holes 499. FIG. 25 is a staggered cross section view of FIG. 24 which shows all of the holes 495 and 499 and indicates the staggered path by the angles 505a and 505b in discussion arrow 505.

As shown in FIG. 25, the plug is held together by a press fit in which the bottom circumference of base 483 is slightly smaller than the circumference of cap 485. In operation, when pressure increases in cartridge 1, air, potentially containing toner particles, enters openings 491 which are inside of hopper 61. That air enters circular chamber 507, as illustrated by arrow 505, and is blocked by wall 497 immediately opposite hole 491 and, therefore, must move right or left, as illustrated by bent arrow 505a, to reach openings 499. The air then enters chamber 509. That air is blocked by wall 493 and also must move right or left, as illustrated by bent arrow 505b, to reach openings 495, which are on the opposite end of chamber 509. Upon passing through openings 495, as shown by arrow 505, the air enters central chamber 511 and passes through felt filter 501 and then out of cartridge 1 through holes 503. (FIG. 23 shows four central flanges 513a-513d, which divide chamber 511 into four equal parts. However, flanges 513a-513d are for structural support of felt disk 501 and, functionally, chamber 511 can be a single chamber.)

The labyrinth configuration of this construction of plug 143 results in continuing operation as an air vent with only minor accumulation of toner inside of the plug 143. The internal chambers 507, 509 and 511 are concentric circles.

We claim:

1. A toner cartridge subject to increases in pressure in internal regions containing toner during operation,

said cartridge having an opening in the side of said cartridge and a removable plug which fits in and closes said opening in said cartridge,

said plug having openings into said cartridge communicating with a labyrinth of chambers reached by staggered paths,

said labyrinth communicating with holes in said plug leading to the outside of said cartridge,

and a filter located in said plug between said openings into said cartridge and the outside of said cartridge which blocks toner from passing through said holes leading to the outside.

2. The toner cartridge as in claim 1 in which said plug has a central chamber communicating with said labyrinth and said filter is located between said central chamber and said holes leading to the outside.

3. The toner cartridge as in claim 2 in which said labyrinth comprises

a first chamber communicating with said cartridge through said openings into said cartridge, and

a second chamber having openings, said openings of said second chamber communicating with said first chamber and not facing said openings into said cartridge,

said central chamber communicating with said second chamber, said openings of said central chamber being on the opposite side of said second chamber from said openings of said second chambers and not facing said openings of said second chamber.

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4. The toner cartridge as in claim 3 in which said cartridge contains electrophotographic toner for developing electrostatic imaging.

5. The toner cartridge as in claim 2 in which said cartridge contains electrophotographic toner for developing electrostatic imaging.

6. The toner cartridge as in claim 1 in which said labyrinth comprises

a first chamber communicating with said cartridge through said openings into said cartridge,

a second chamber having openings, said openings of said second chamber communicating with said first chamber and not facing said openings into said cartridge, and

a third chamber having openings communicating with said second chamber, said openings of said third chamber being on opposite side of said second chamber from said openings of said second chamber and not facing said openings of said second chamber.

7. The toner cartridge as in claim 6 in which said cartridge contains electrophotographic toner for developing electrostatic imaging.

8. The toner cartridge as in claim 1 in which said cartridge contains electrophotographic toner for developing electrostatic imaging.

9. A venting plug for an electrophotographic toner cartridge comprising

a first chamber having openings on the outside of said plug for insertion into an electrophotographic cartridge,

a second chamber having openings, said openings of said second chamber communicating with said first chamber and not facing said openings for insertion into an electrophotographic cartridge,

a third chamber having first openings communicating with said second chamber, said first openings of said third chamber not facing said openings of said second chamber, said third chamber also having second openings located generally on the opposite side of said plug from said openings for inserting into an electrophotographic cartridge, and

a filter located in said plug between said openings for insertion into an electrophotographic cartridge and the outside of said plug which blocks toner from passing through said second chamber.

10. The venting plug as in claim 9 in which said third chamber is in the center of said plug and said filter is located between said third chamber and said second openings.

11. The venting plug as in claim 10 in which said first openings of said third chamber are on the opposite end of said second chamber from said openings of said second chamber.

12. The venting plug as in claim 11 in which said first chamber, said second chamber, and said third chamber are concentric circles.

13. The venting plug as in claim 10 in which said first chamber, said second chamber, and said third chamber are concentric circles.

14. The venting plug as in claim 9 in which said first openings of said third chamber are on the opposite end of said second chamber from said openings of said second chamber.

15. The venting plug as in claim 14 in which said first chamber, said second chamber, and said third chamber are concentric circles.

16. The venting plug as in claim 9 in which said first chamber, said second chamber, and said third chamber are concentric circles.

\* \* \* \* \*

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# THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 04, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: 5,758,233

ISSUE DATE: May 26, 1998

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



T. LAWRENCE  
Certifying Officer



US005758233A

**United States Patent** [19][11] **Patent Number:** 5,758,233**Coffey et al.**[45] **Date of Patent:** May 26, 1998[54] **TONER CARTRIDGE WITH LOCATING ON PHOTOCONDUCTOR SHAFT**[75] **Inventors:** Johnnie A. Coffey, Winchester; Larry Steven Foster; Paul Douglas Horrall, both of Lexington; David Erwin Rennick, Georgetown, all of Ky.[73] **Assignee:** Lexmark International, Inc., Lexington, Ky.[21] **Appl. No.:** 770,326[22] **Filed:** Dec. 20, 1996[51] **Int. Cl.<sup>6</sup>** ..... G03G 15/00; G03G 21/18[52] **U.S. Cl.** ..... 399/111; 399/110[58] **Field of Search** ..... 399/110, 111, 399/113, 116, 119, 262[56] **References Cited****U.S. PATENT DOCUMENTS**

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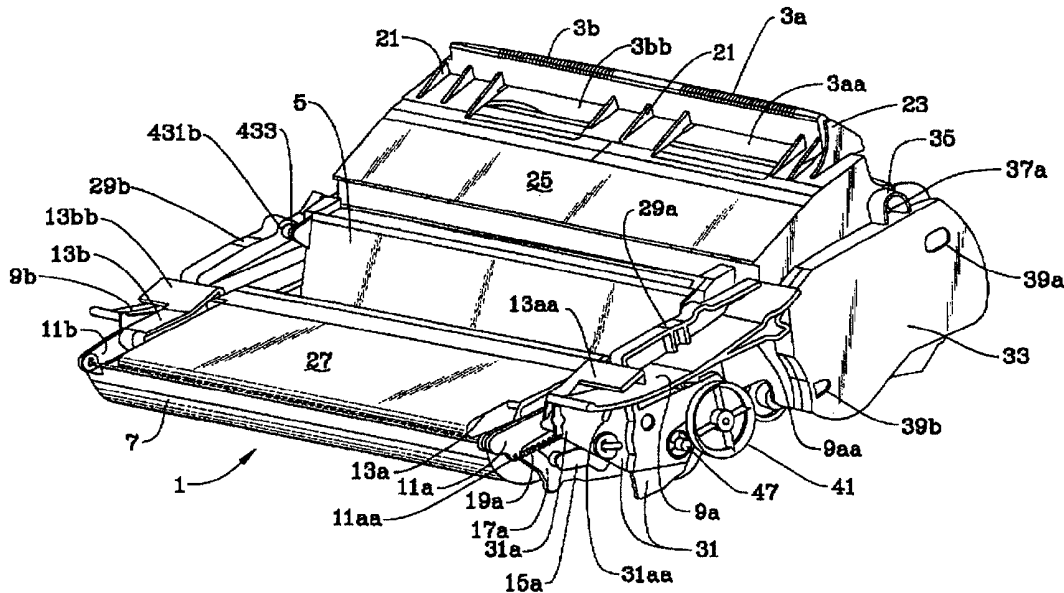
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*Primary Examiner*—Arthur T. Grimley*Assistant Examiner*—Sophia S. Chen*Attorney, Agent, or Firm*—John A. Brady[57] **ABSTRACT**

A toner cartridge (1) contains a photoconductive drum (43) having a central shaft (47). The shaft extends outward from the sides of the cartridge so that it can be lowered on a V-shaped locator (301) in the printer. An assembly of a hopper (61), toner adder roller (45) and developer roller (43) is attached to an assembly carrying the photoconductive drum through springs (132a, 132b). The hopper assembly has center locating surfaces (29a, 29b) to receive a downward pressing member from the printer and flat ledges (161a, 133a) to contact rollers in the printer, which permits adjustment of the contact between the drum and the developer roller while positively locating the drum. The cover assembly also has flat locating surfaces (449, 451) near the hopper to rest on the printer frame.

**4 Claims, 23 Drawing Sheets**

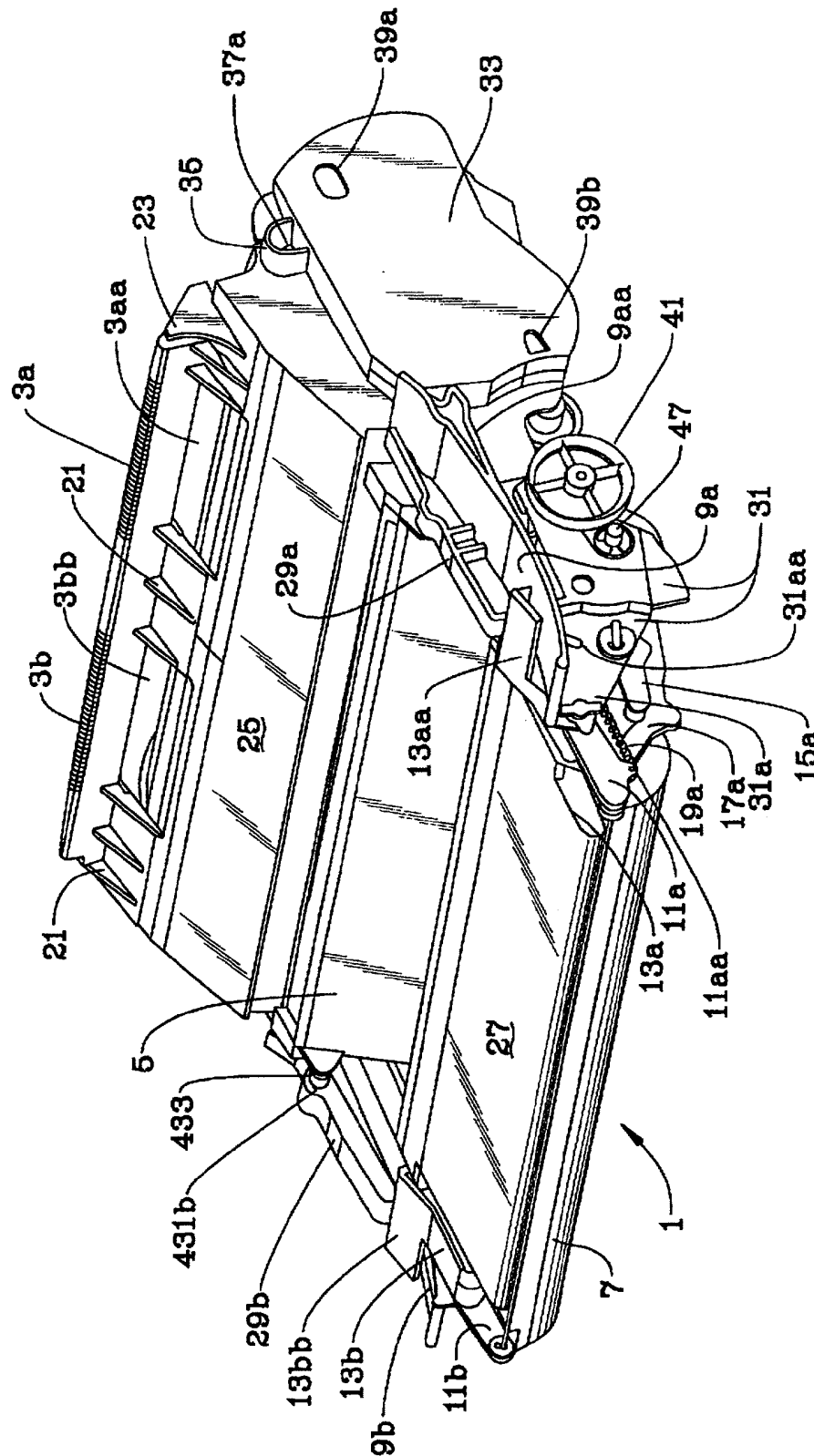
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FIG. 1



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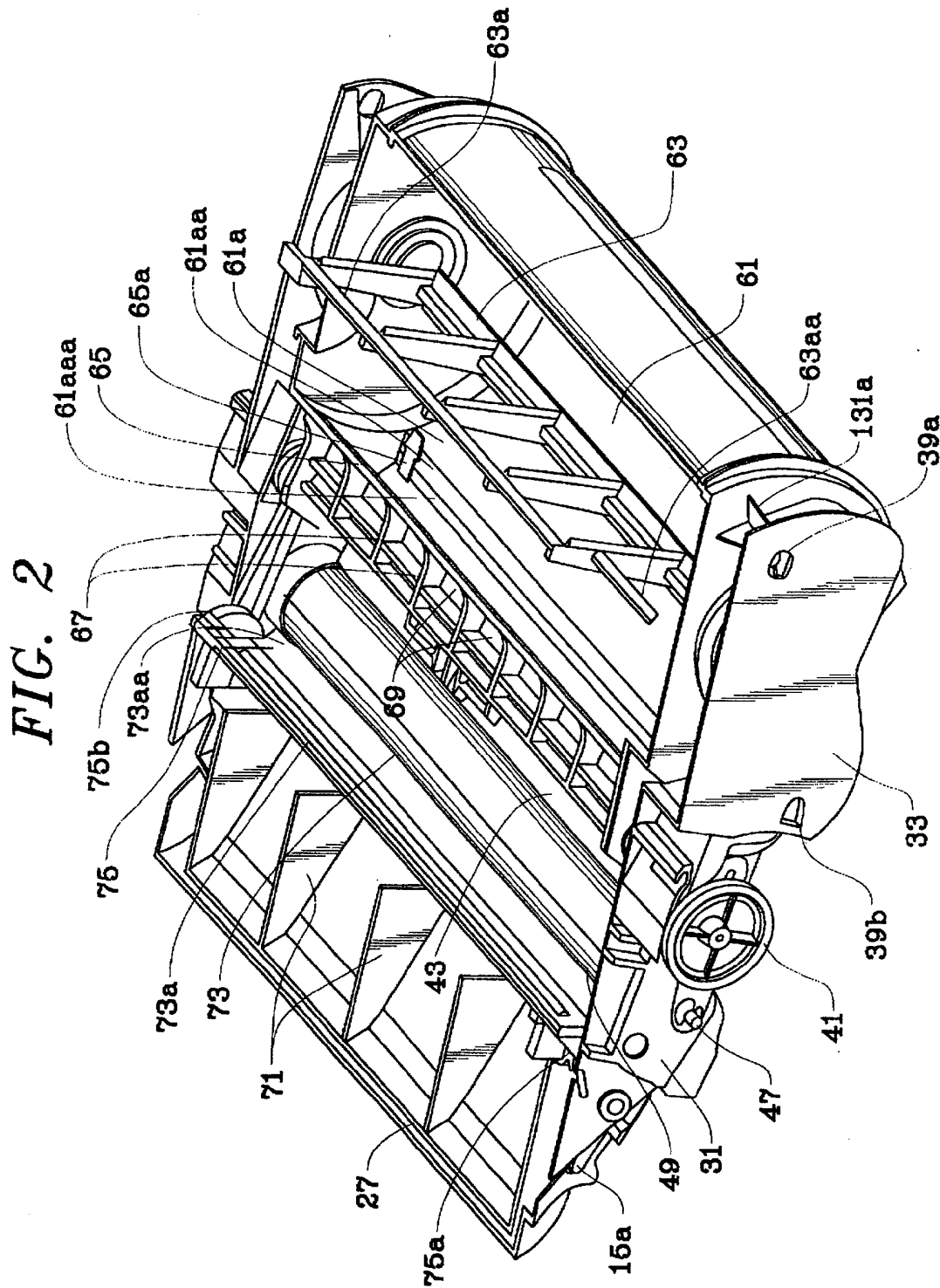


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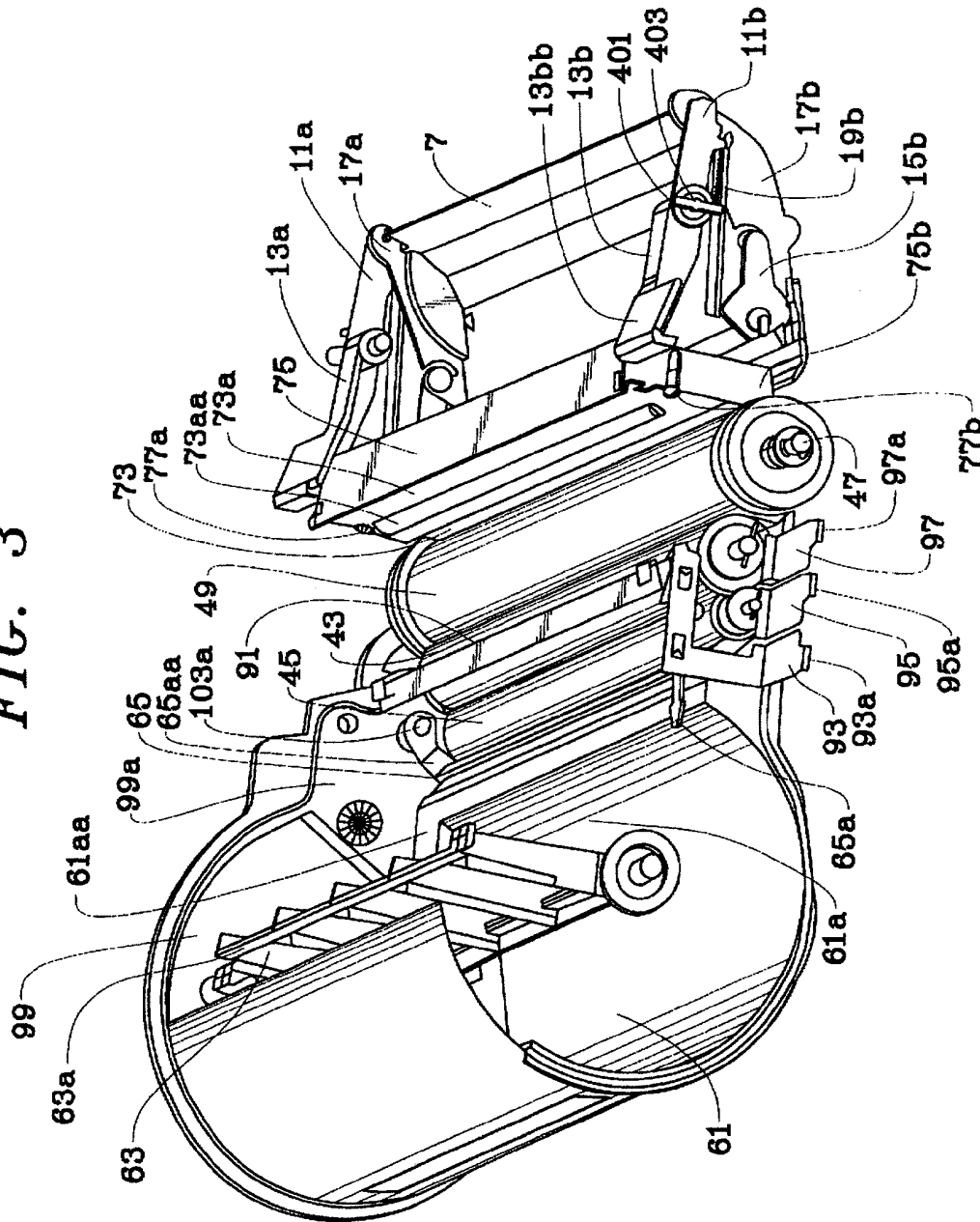
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**FIG. 3**

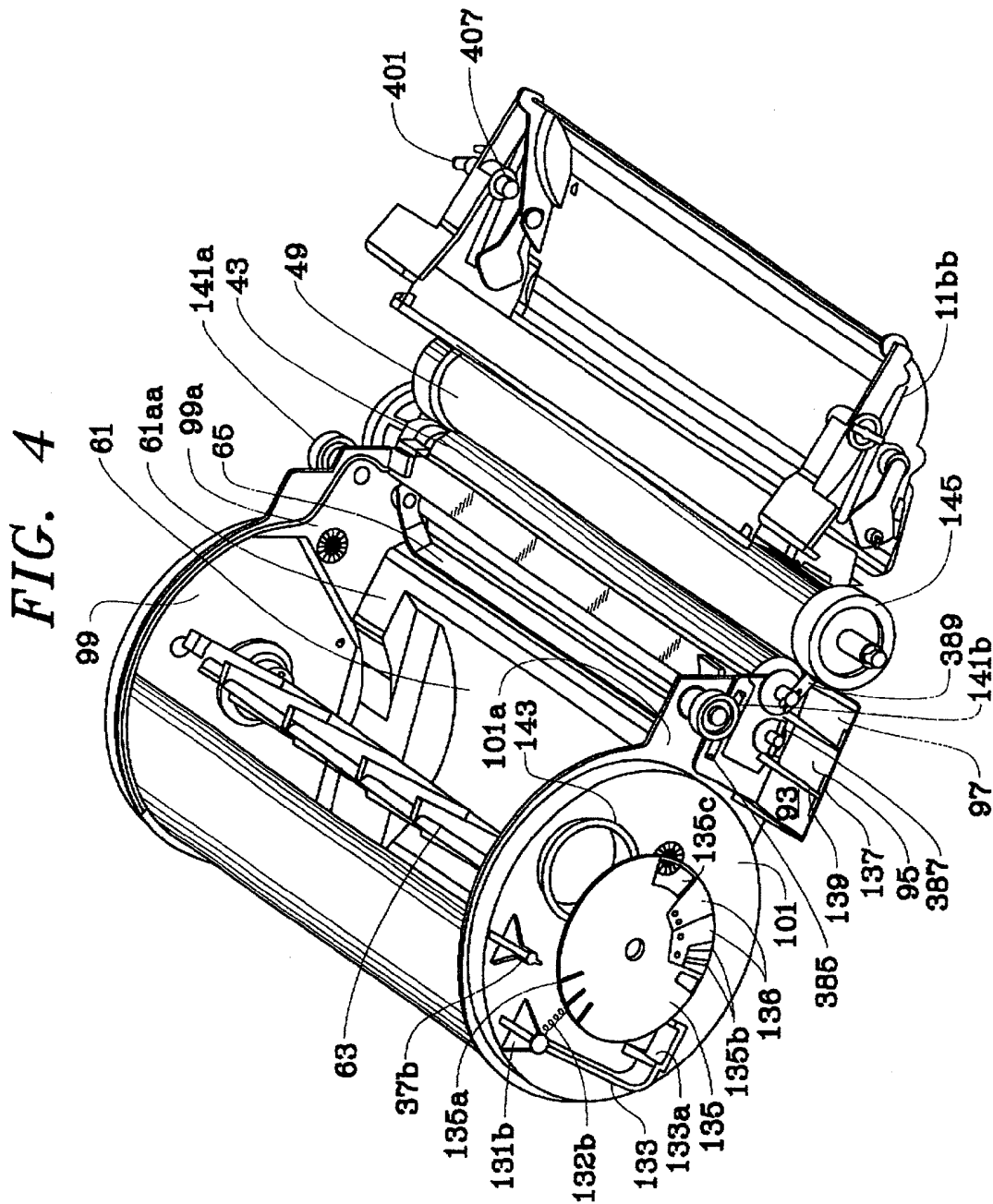


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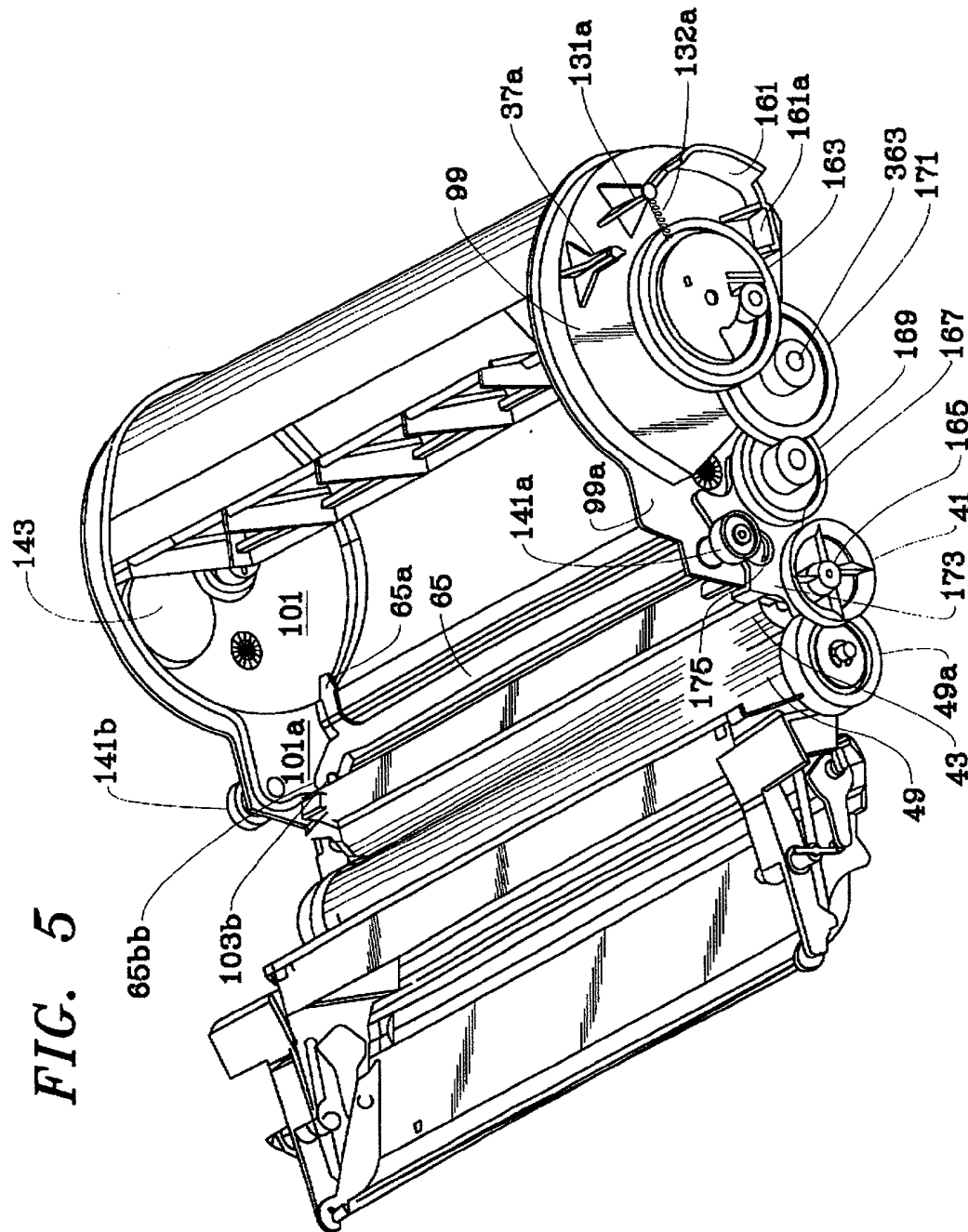


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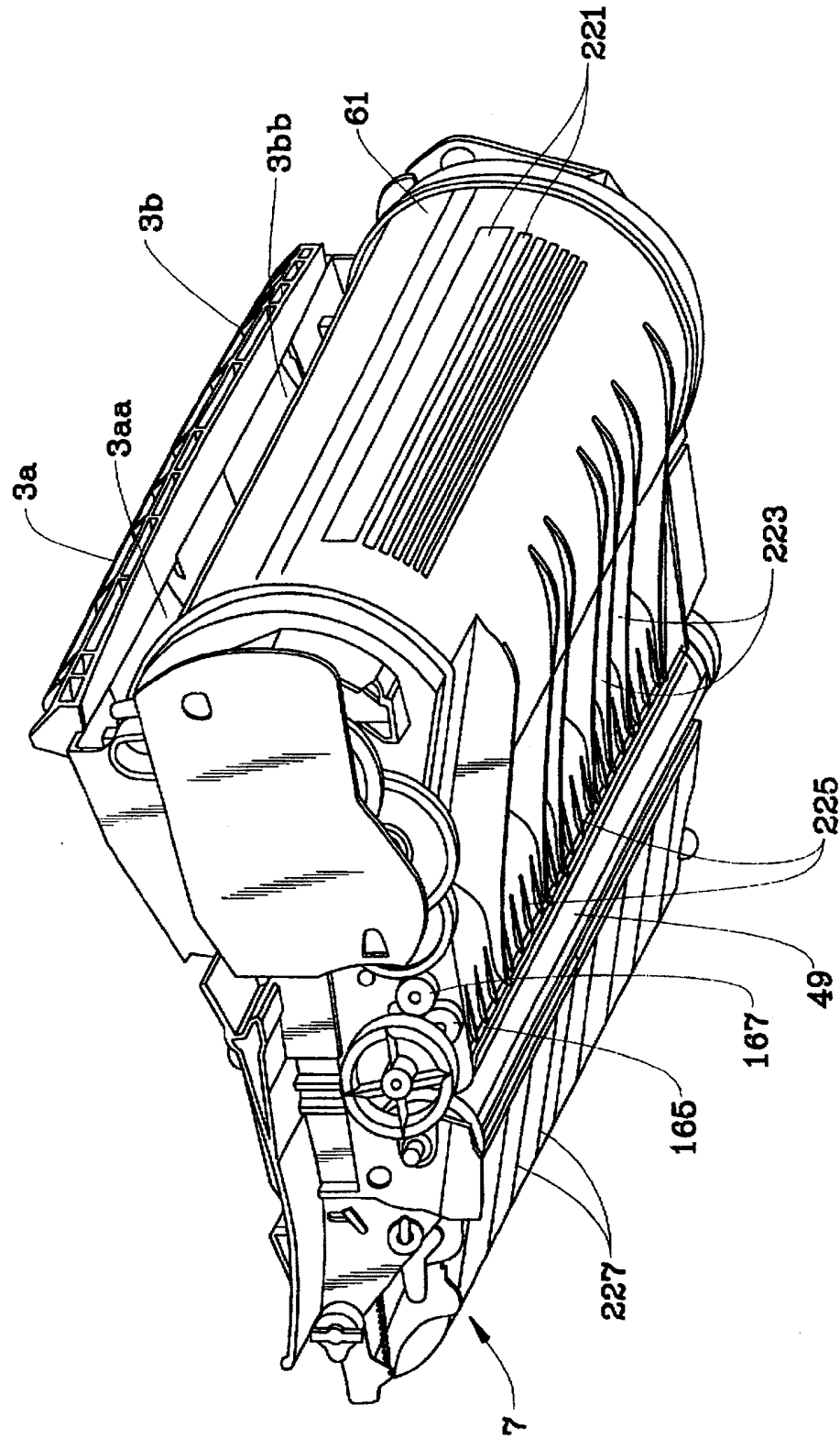
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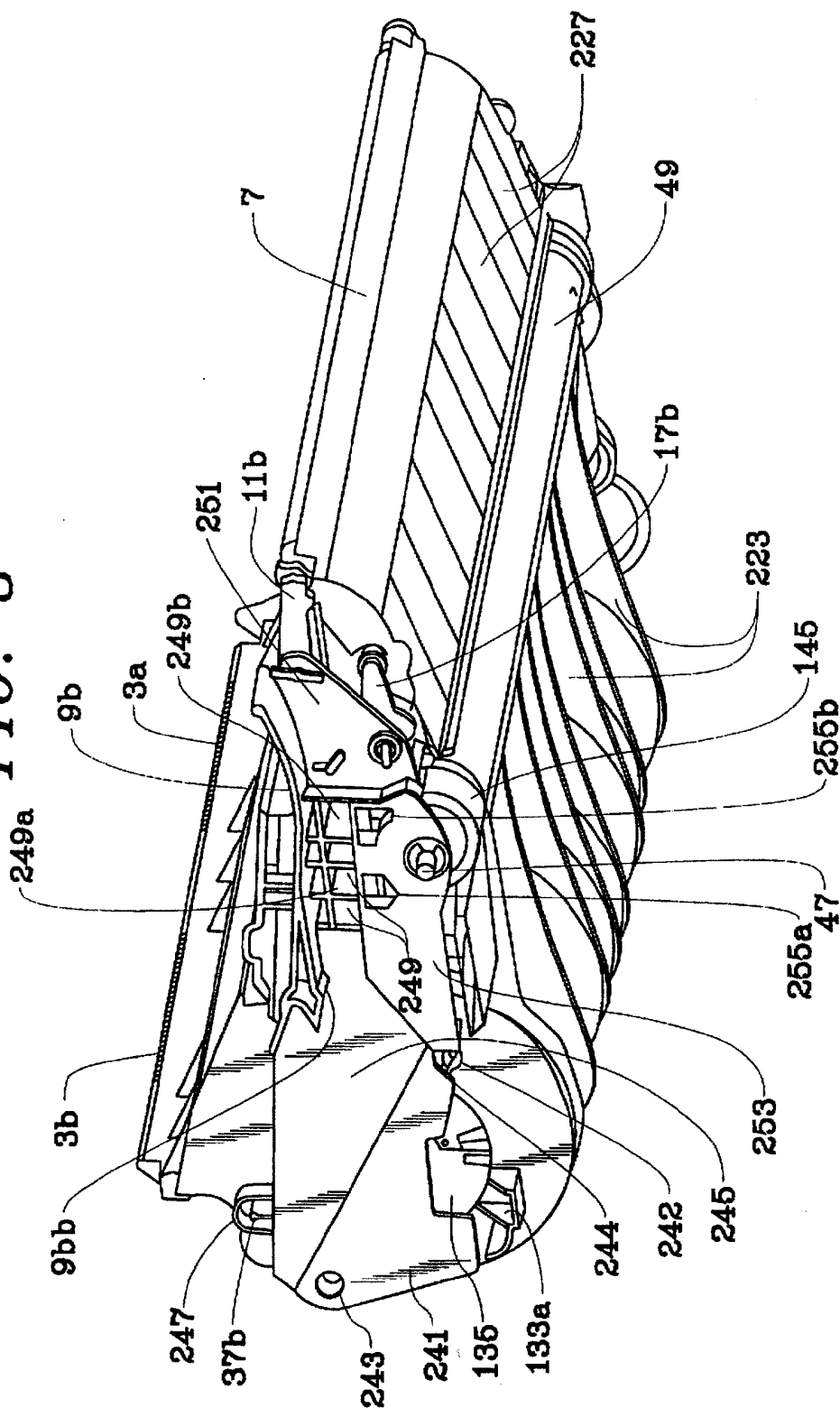
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FIG. 7





**FIG. 8**



**A4093.**



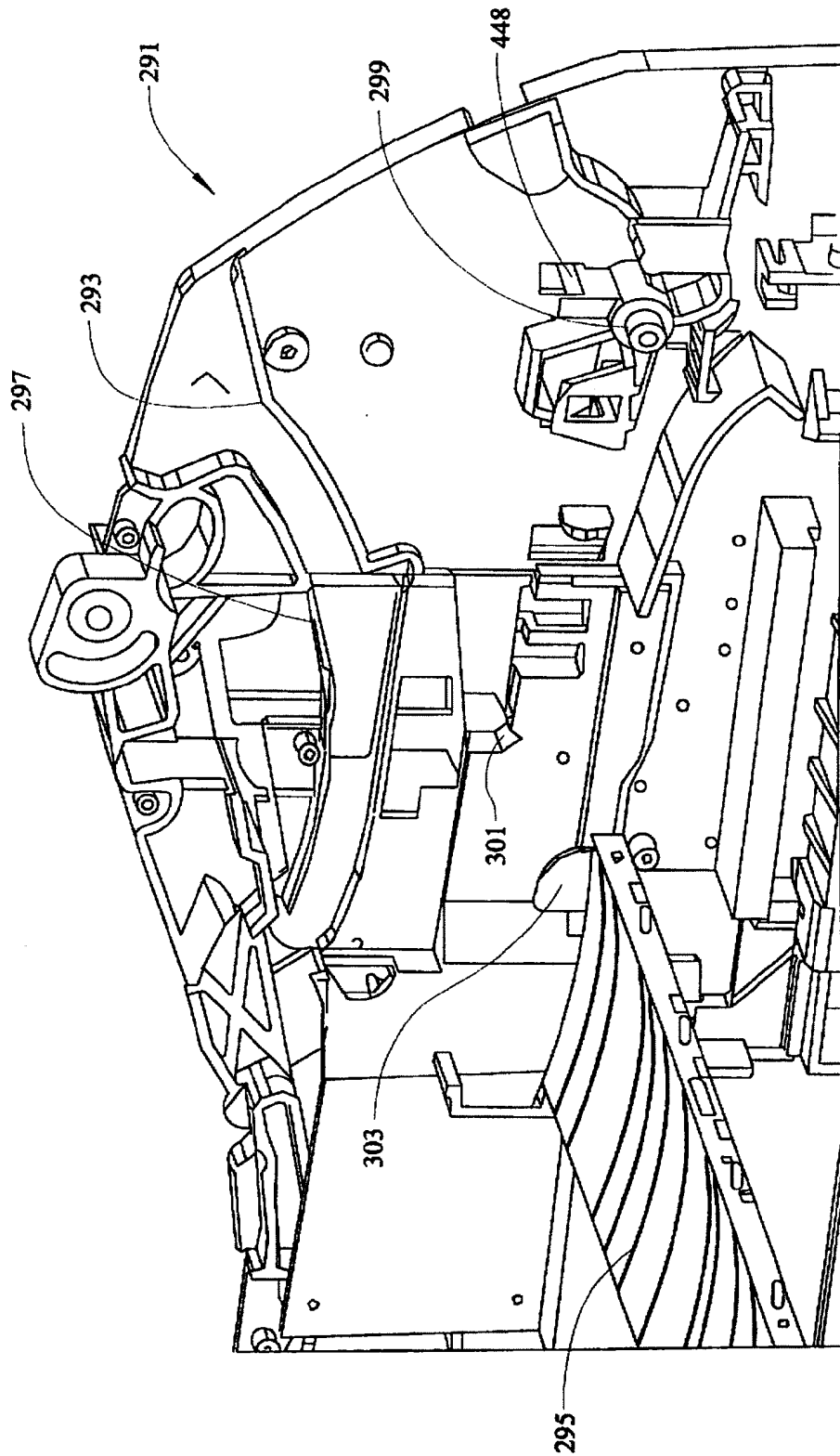
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FIG. 10



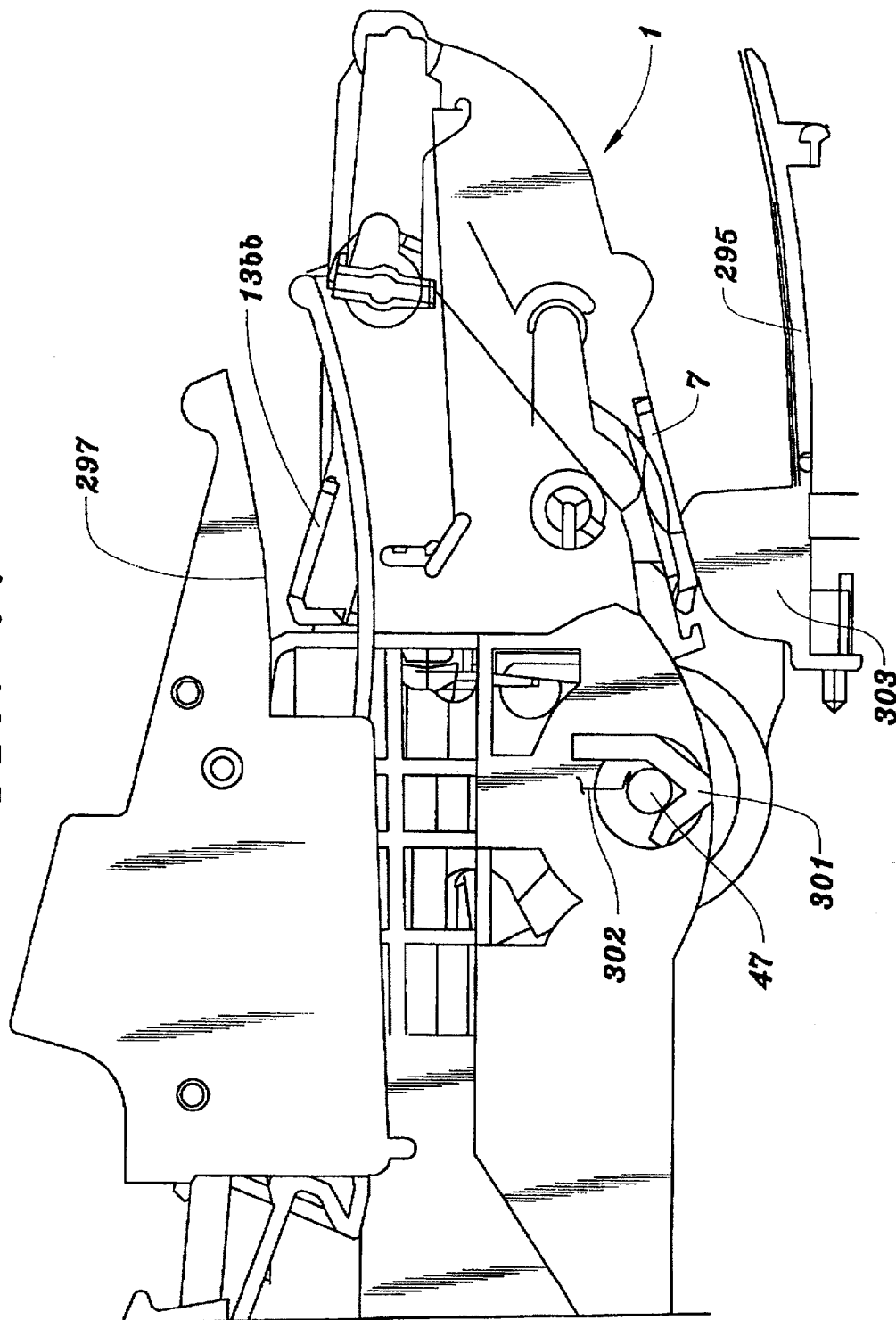
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FIG. 11

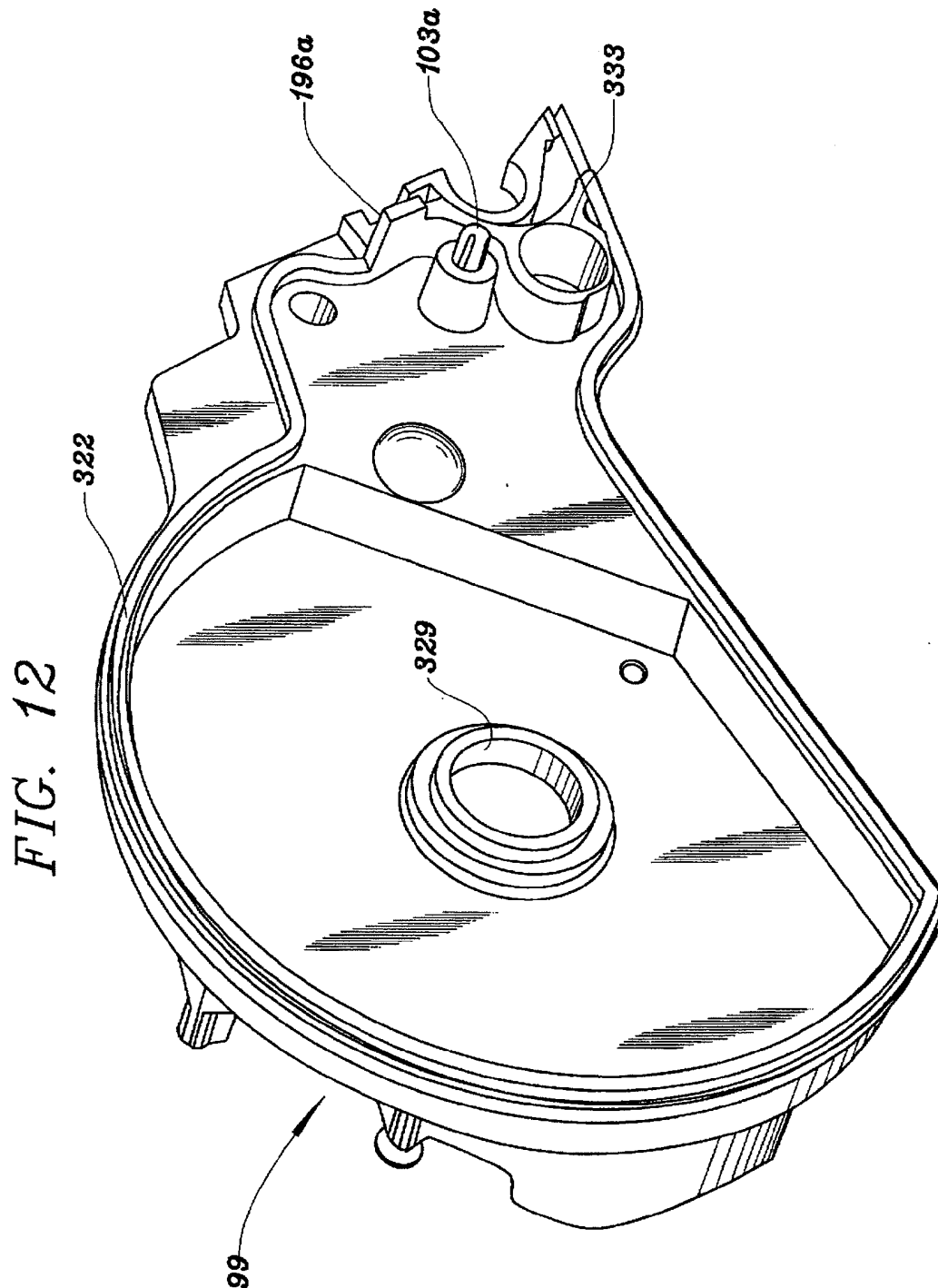


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A4097

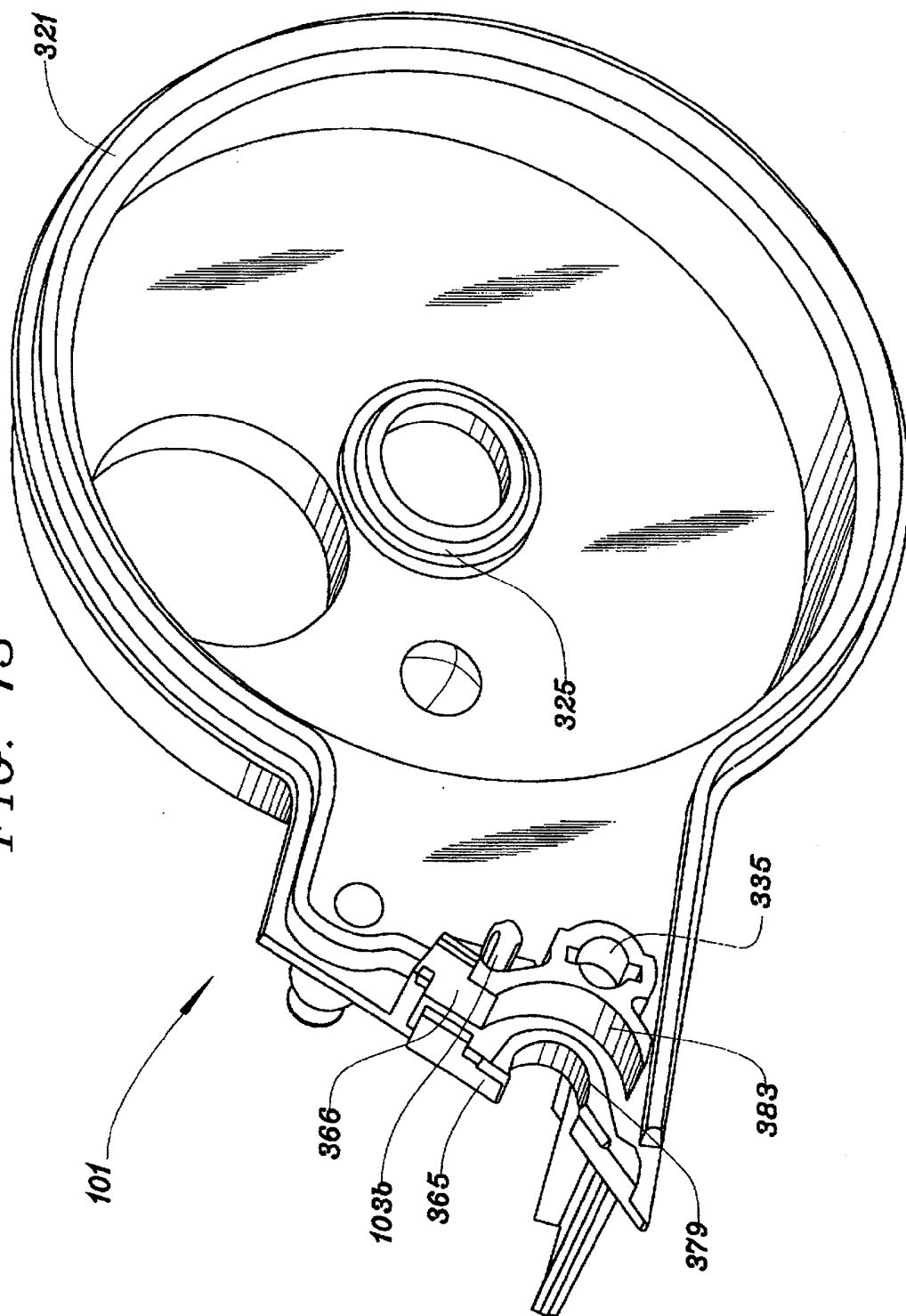
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FIG. 13



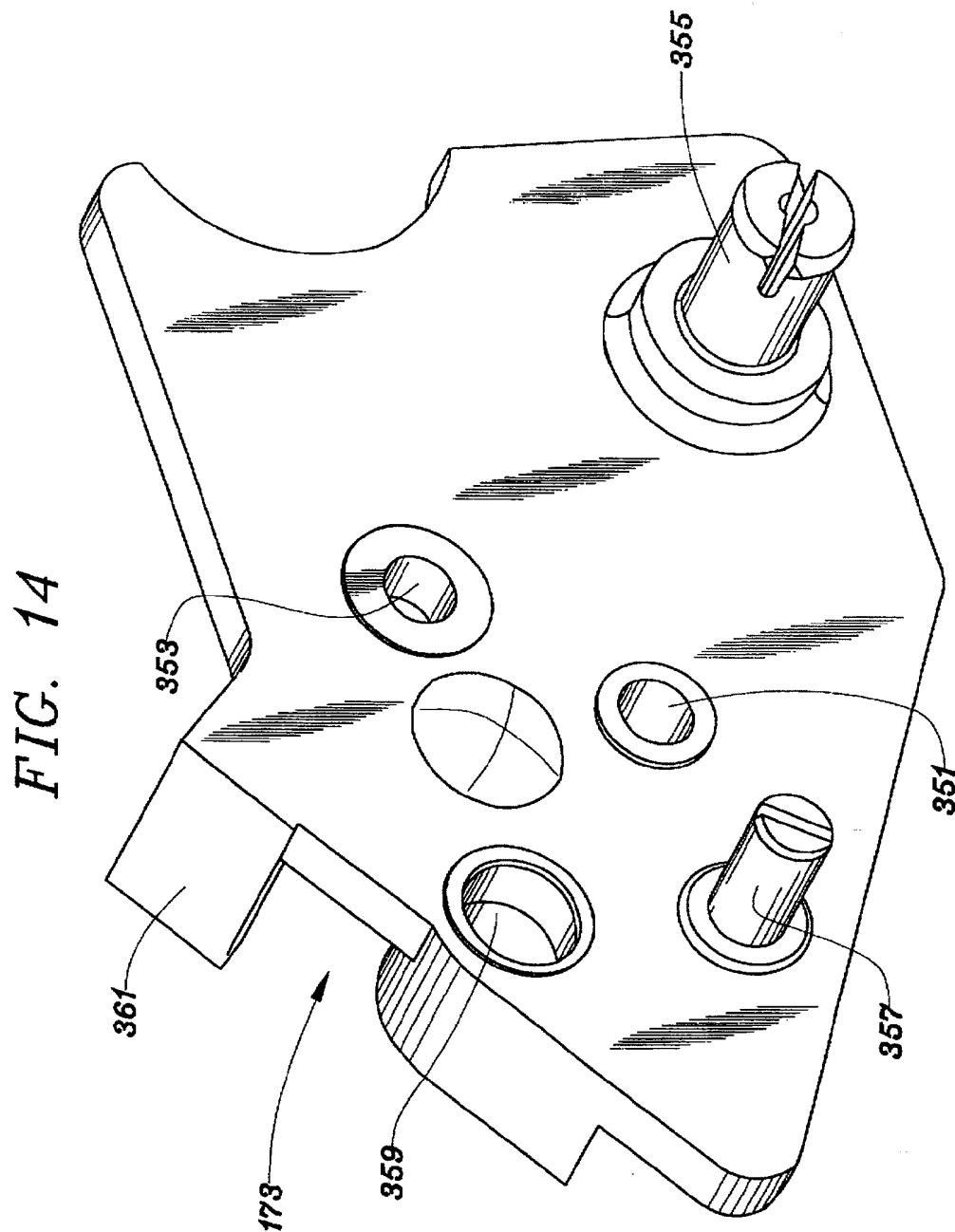


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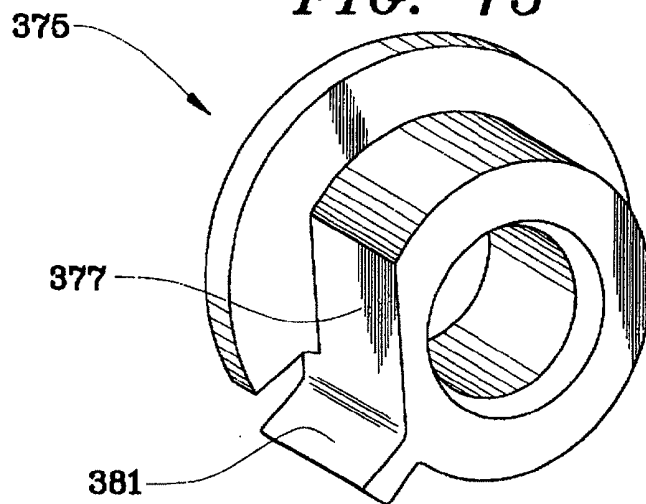
U.S. Patent

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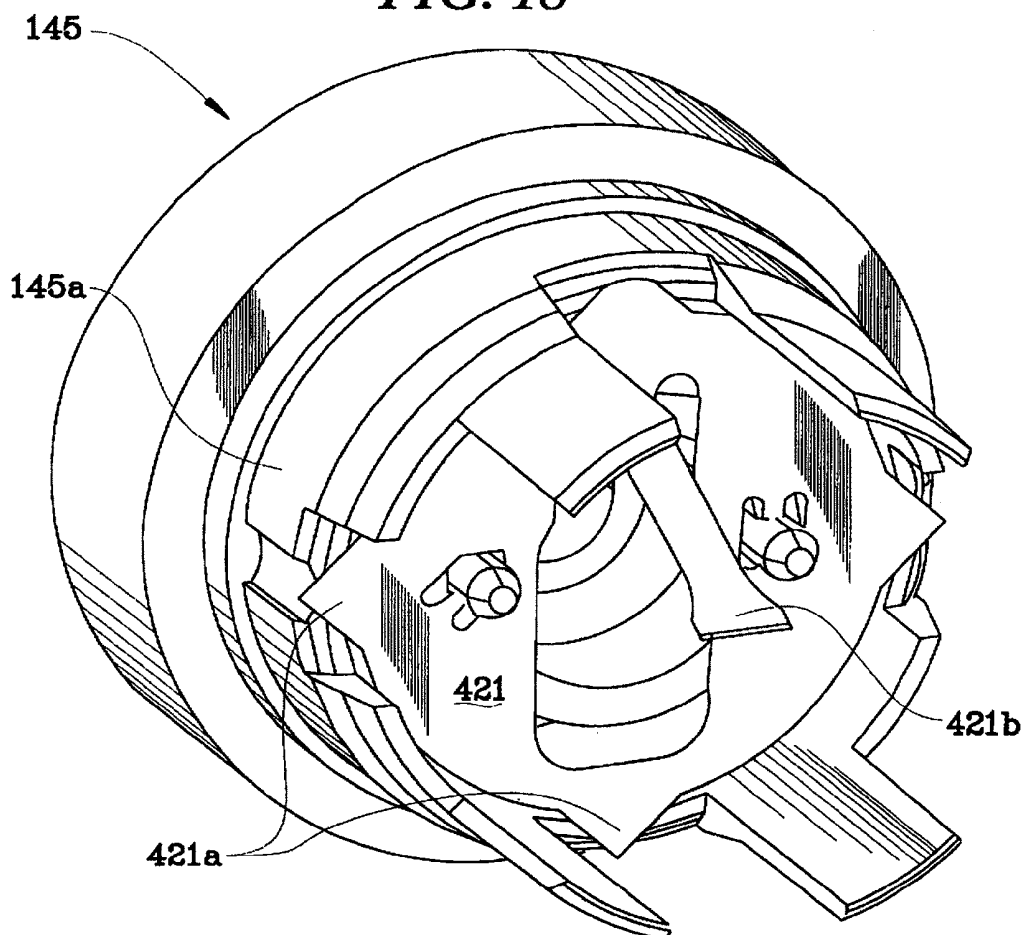
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*FIG. 15*



*FIG. 18*



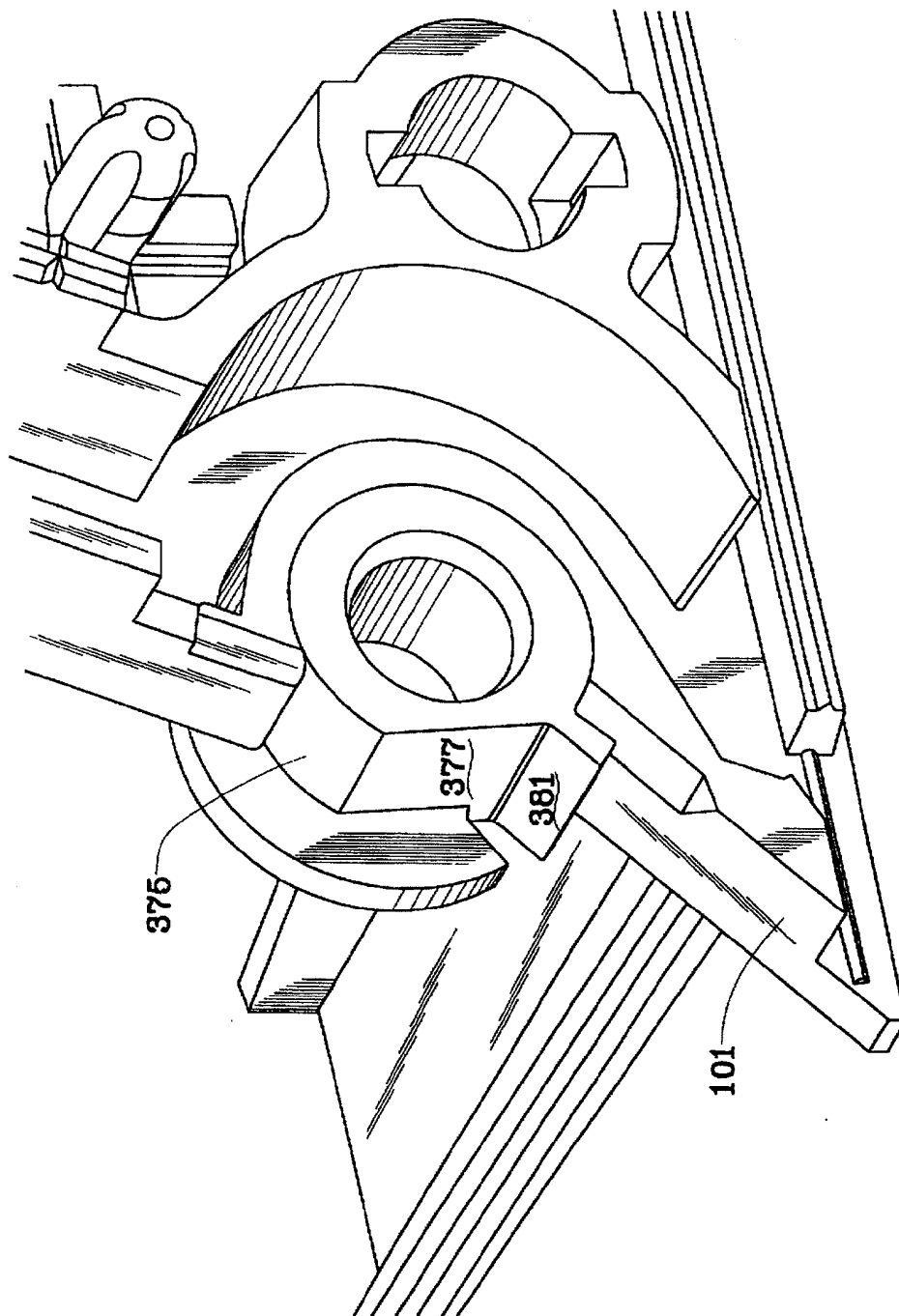
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FIG. 16



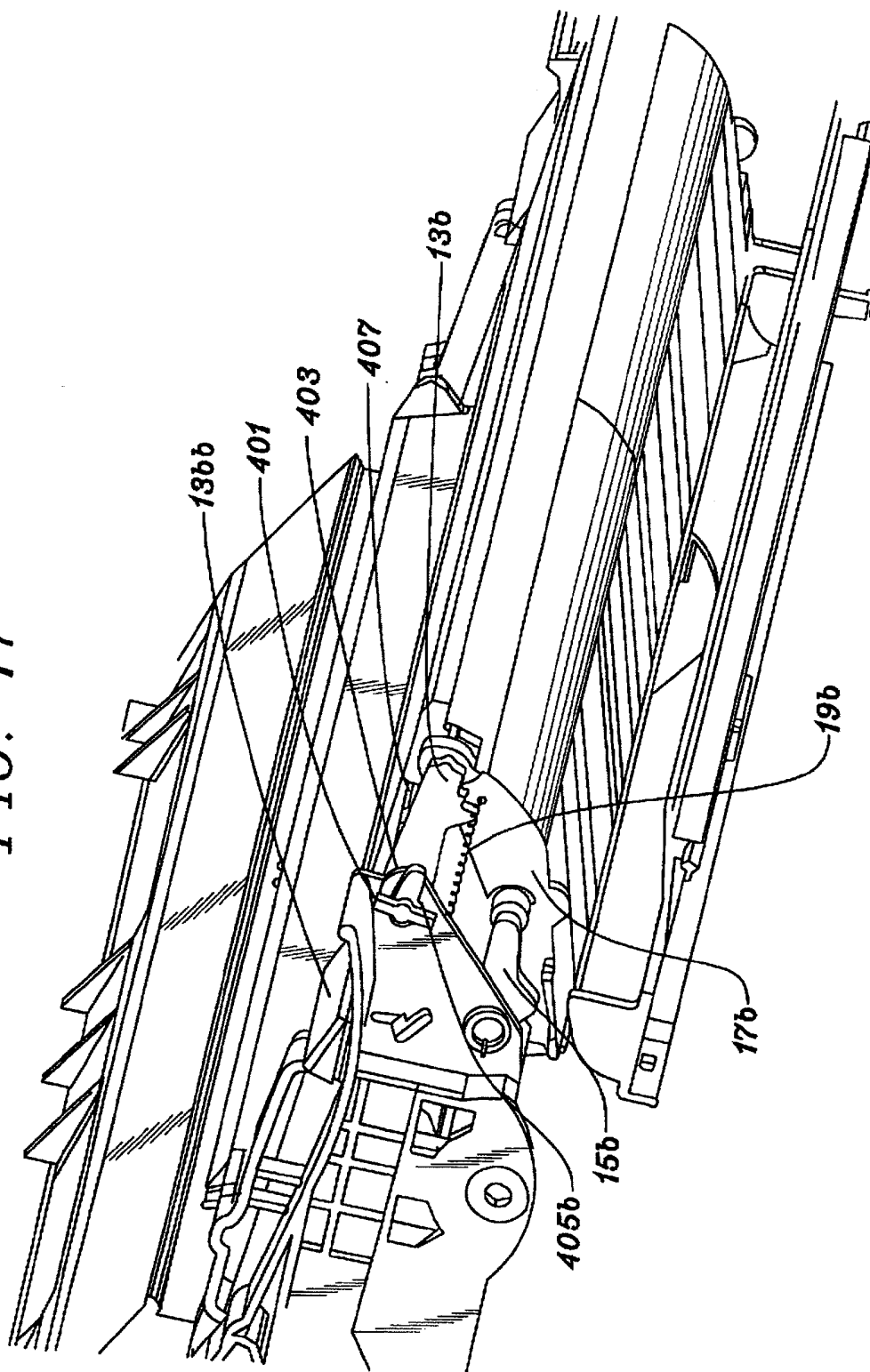
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FIG. 17

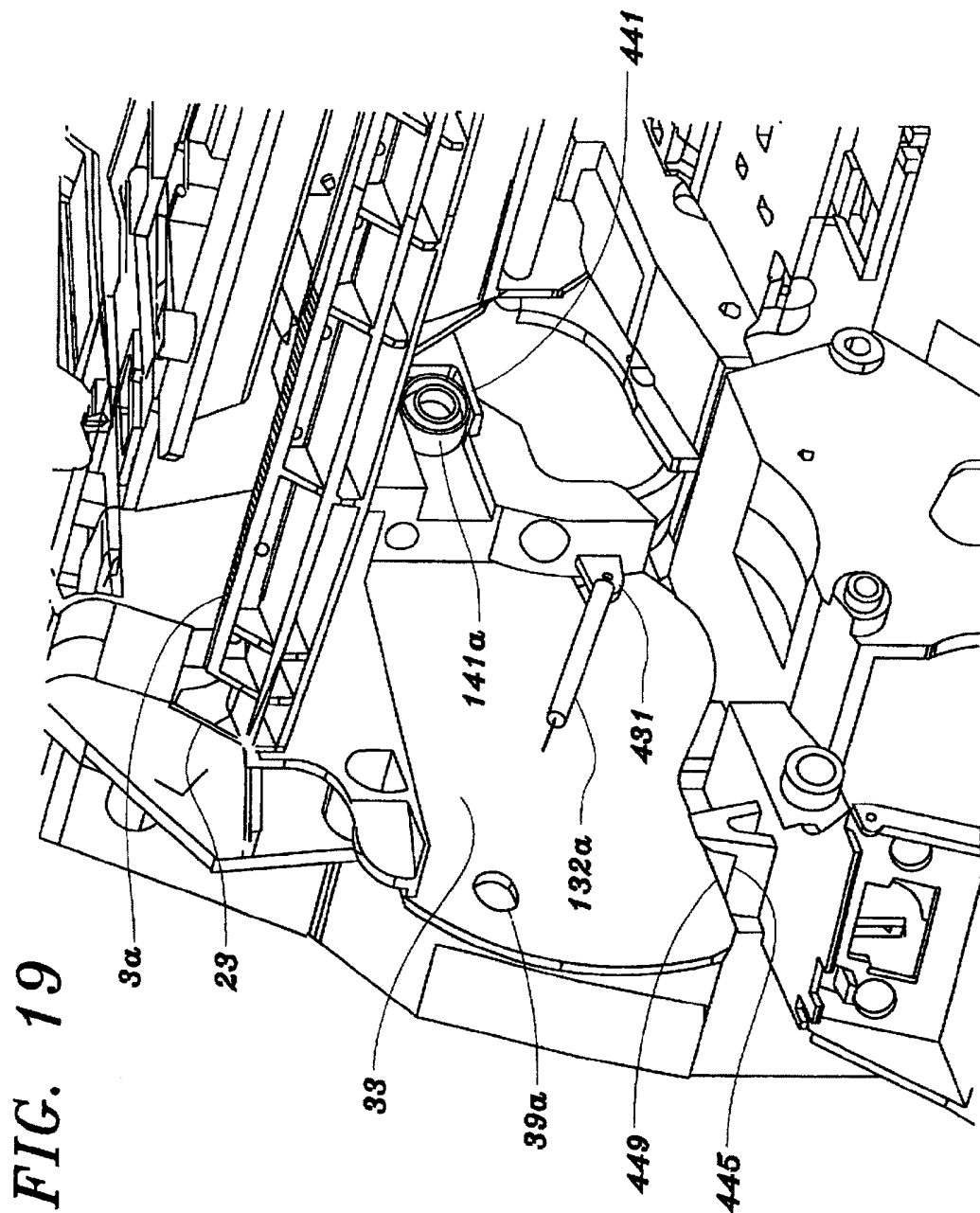


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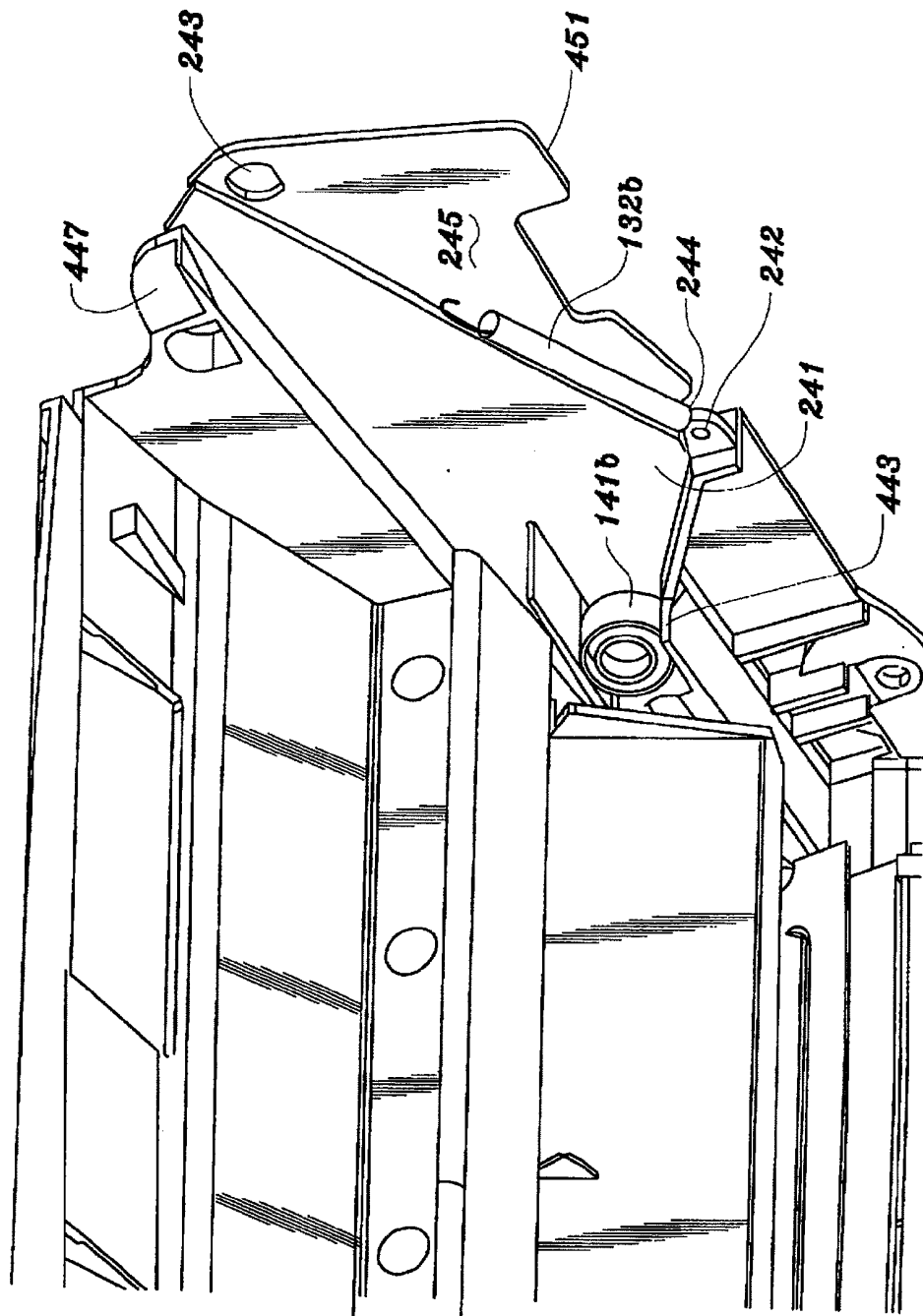
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FIG. 20





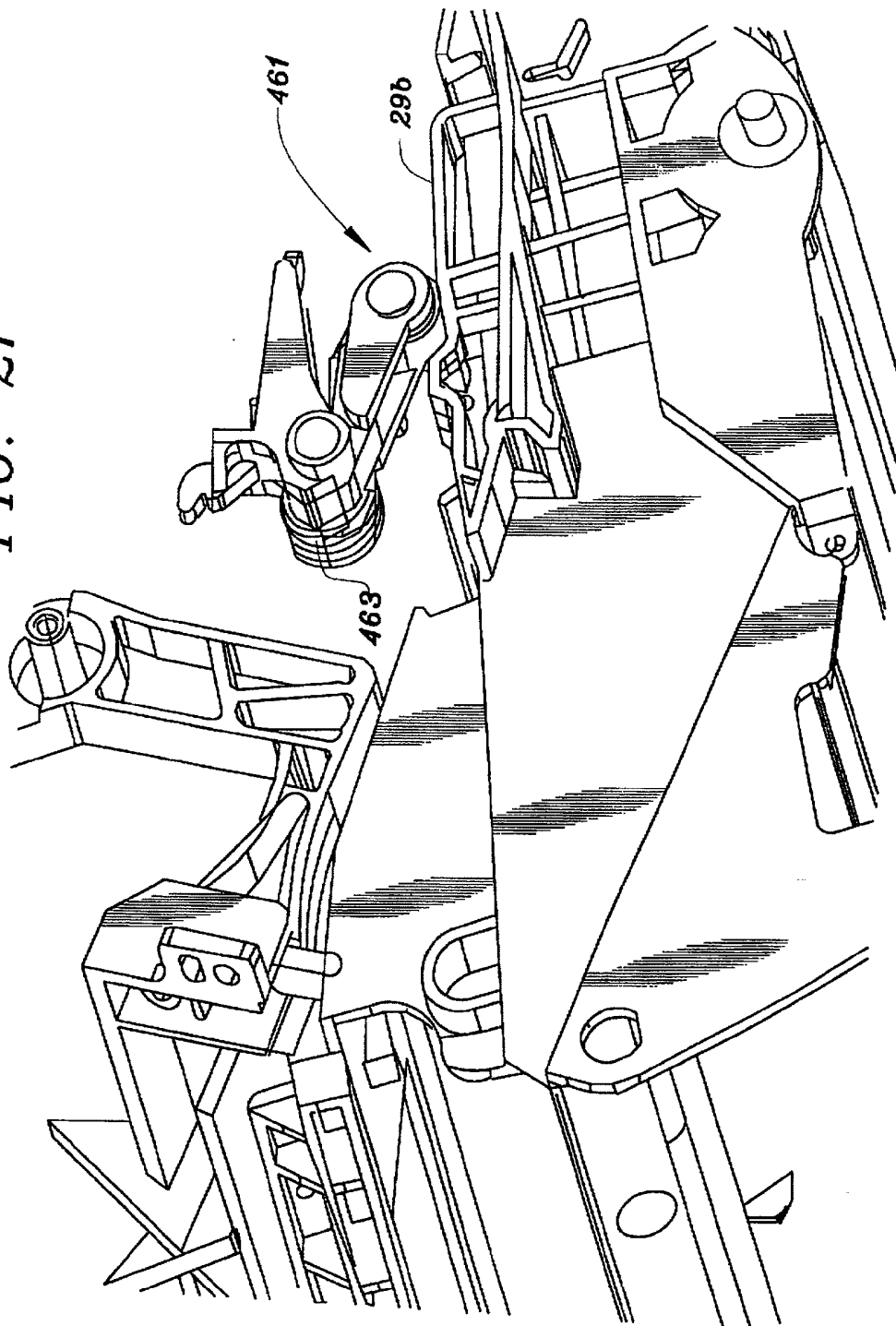
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FIG. 21



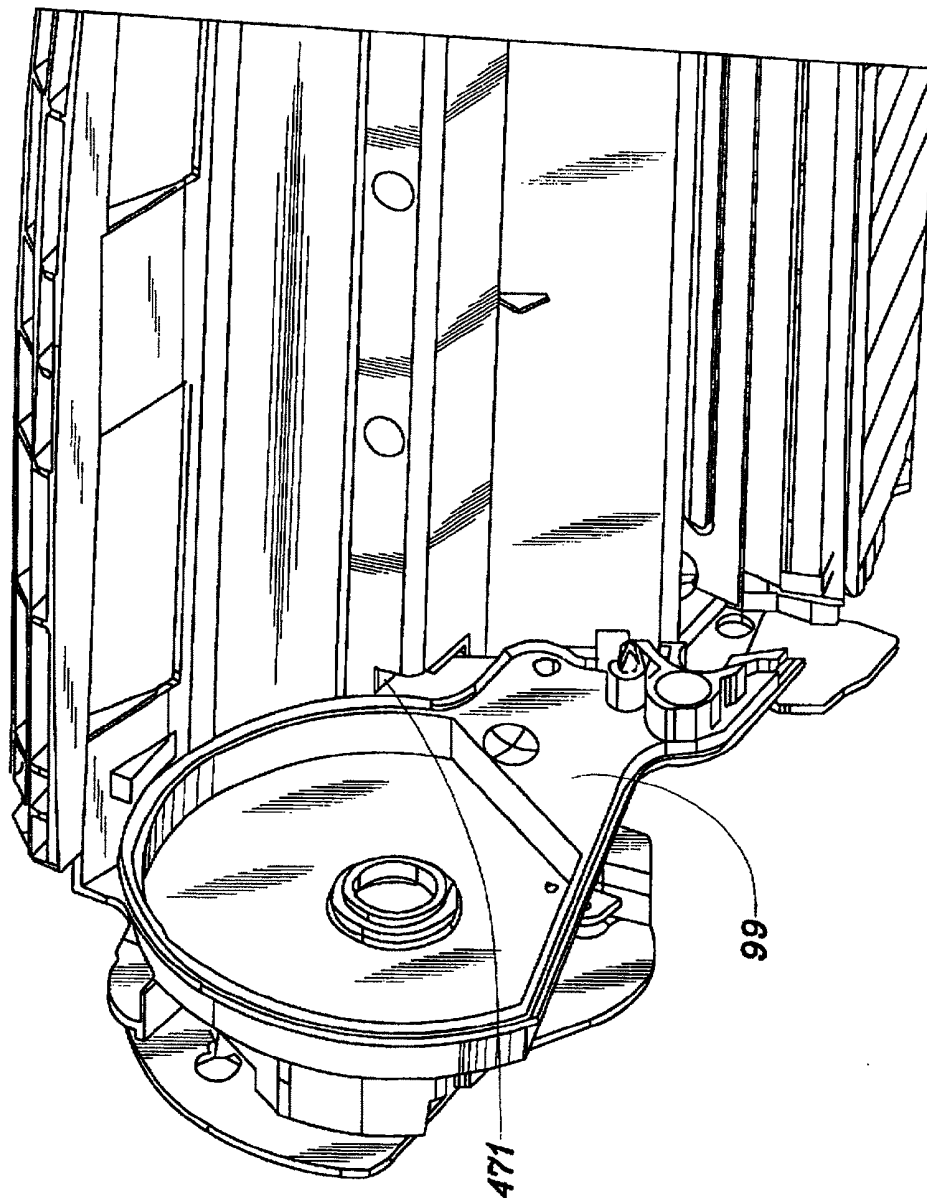
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FIG. 22



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FIG. 24

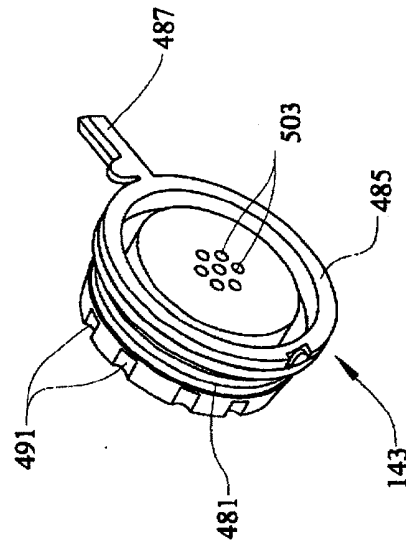
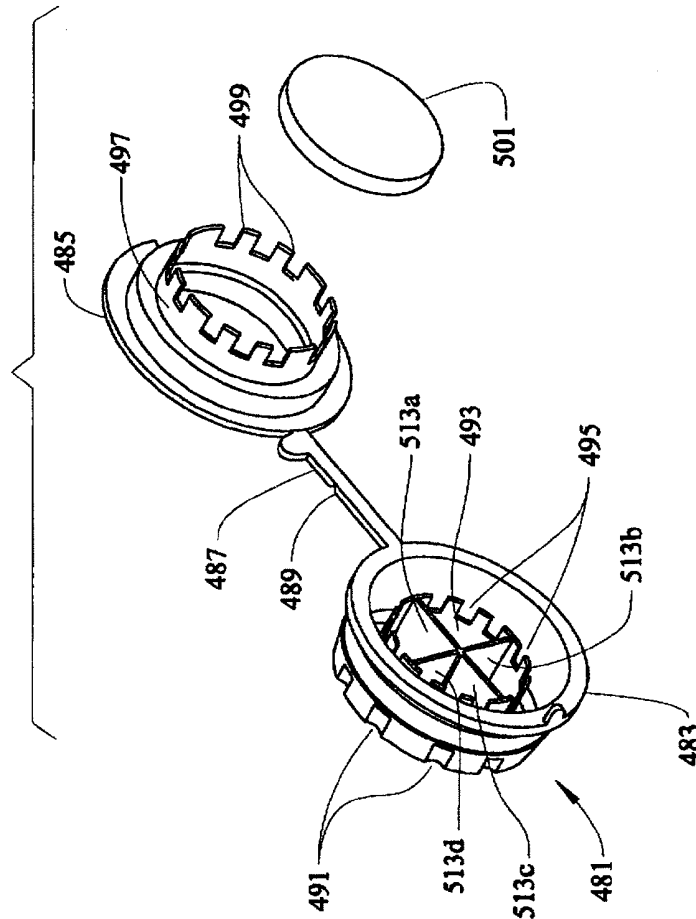


FIG. 23





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## TONER CARTRIDGE WITH LOCATING ON PHOTOCONDUCTOR SHAFT

### CROSS-REFERENCE TO RELATED APPLICATIONS

The following United States patent applications are directed to subject matter disclosed or incorporated in the disclosure of this application Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169 entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device; five utility applications filed the same day as this application entitled "Toner Cartridge with External Planar Installation Guides," Ser. No. 08/770,327; "Toner Cartridge with Hopper Exit Agitator," Ser. No. 08/770,328; "Toner Cartridge with Housing and Pin Construction," Ser. No. 08/770,330; "Toner Cartridge with Heat Shield Shutter," Ser. No. 08/770,334; and "Venting Plug in Toner Cartridge," Ser. No. 08/770,329 and one ornamental design application filed the same day as this application entitled "Toner Cartridge for Laser Printer, Ser. No. 29/066,775.

### TECHNICAL FIELD

This invention relates to electrophotographic development and, more particularly, relates to a toner cartridge having no toner pump and associated structure.

### BACKGROUND OF THE INVENTION

The assignee of this invention has manufactured and sold commercially toner cartridges of two different general designs. For its larger laser printers the cartridge has contained a pump to meter toner of the kind disclosed in U.S. Pat. Nos. 5,012,289 to Aldrich et al. and 5,101,237 to Molloy, while the external structure of the cartridge is as disclosed in U.S. Pat. No. 5,136,333 to Craft et al. Details of other elements in the cartridge have varied.

For a smaller, light emitting diode printer, the cartridge is as disclosed in U.S. Pat. No. 5,337,032 to Baker et al., which has a toner hopper extending well below a level having the toner adder roller and which has independent driven systems for the photoconductor roller and for the developer roller system as disclosed in U.S. Pat. No. 5,331,378 to Baker et al.

Cartridges are typically located by elements on their cover or frame, not directly based on the location of photoconductor. This invention employs the shaft of the photoconductor drum as the primary locator and a flat ledge opposite for resting on a roller member in the printer. Prior cartridges have had at least three wheels riding on tracks connecting the hopper assembly to the housing and photoconductor assembly. These wheels define a plane in which the two assemblies move to adjust the contact force between the developer roller in the hopper assembly and the photoconductor roller in the housing assembly. Having all of those wheels in the cartridge is detrimental in that they add to the positional variations of the developer unit with respect to the paper path. Also, during rough handling, the forward wheels in the cartridge tend to break off under the weight of the toner.

### DISCLOSURE OF THE INVENTION

This invention is a toner cartridge containing a photosensitive roller, the central shaft of which extends unobstructed to be contacted by the printer as a vertical and front to rear

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locator. A hopper and developer roller assembly is attached to the cover assembly through a spring force. The cover assembly has elongated surfaces in its center area to receive a downward pressing member from the printer. The hopper and developer roller assembly has flat ledges to ride on rollers in the printer thereby permitting adjustment of the contact between the photosensitive roller and the developer roller. A cover assembly integral with the photoconductive roller has a locating surface near the hopper which rests on the frame of the printer positively locating the photoconductive roller.

The two front support wheels which define the plane of lateral movement between the two assemblies and are in the printer, with a flat surface on hopper to receive these rollers. Since the under side of the developer unit is part of the media path, referencing the hopper assembly to the printer improves location accuracy of the media path. The cartridge is resistant to rough handling while the corresponding front wheels in the former cartridges tended to break. A minor advantage is that the cost of the wheels and their installation is eliminated from the cartridge.

### BRIEF DESCRIPTION OF THE DRAWING

The details of this invention will be described in connection with the accompanying drawing, in which

FIG. 1 is a perspective view of the toner cartridge from above and left rear, where left is determined facing the printer from its front side where cartridge insertion is made;

FIG. 2 is a perspective view from above and left front of the cartridge sectioned near the top;

FIG. 3 is a top right front view of the cartridge with further cover elements removed;

FIG. 4 is a top right rear view of the cartridge with cover elements removed;

FIG. 5 is a top left rear view of the cartridge with cover elements removed;

FIG. 6 is a top right rear view of the cartridge sectioned similarly to the sectioning of FIG. 2;

FIG. 7 is a bottom left front view of the cartridge;

FIG. 8 is a bottom right rear view of the cartridge;

FIG. 9 is a front right perspective view of the hopper housing member;

FIG. 10 is a left front view of the inside of a printer in which cartridge 1 is installed;

FIG. 11 is a partially sectioned right side view showing more detail of parts shown in FIG. 10 with the cartridge installed;

FIG. 12 is a perspective view showing the inside one end member of the hopper;

FIG. 13 is a perspective view showing the inside of the other end member of the hopper;

FIG. 14 is a perspective view of the gear plate;

FIG. 15 is a perspective view of a readily removable bushing;

FIG. 16 is a perspective view showing the removable bushing installed;

FIG. 17 is a right rear view showing detail of a shutter;

FIG. 18 is a perspective view of an extended hub inserted in the photoconductor drum;

FIG. 19 is a right perspective view showing elements inside the cover of the cartridge;

FIG. 20 is a left bottom perspective view showing elements inside the cover of the cartridge;

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FIG. 21 is a right perspective view showing parts of the cartridge installed in a printer; and

FIG. 22 shows the inside of the cover of the cartridge where it receives an extension from the hopper;

FIG. 23 shows elements of the hopper plug prior to assembly;

FIG. 24 shows the assembled hopper plug alone; and

FIG. 25 shows a staggered cross section of the hopper plug to illustrate air flow.

### BEST MODE FOR CARRYING OUT THE INVENTION

The self-contained, removable printer cartridge 1 is shown in FIG. 1 in a perspective view from above and left rear (the hand grips 3a and 3b being considered the front and the side having the pivoted upper shutter 5 being the upper side).

For purposes of illustration, FIG. 1 shows the upper shutter 5 pivoted downward to its open position and lower shutter 7 pivoted rearward and upward to its open position. In actual operation, these positions are reached by interaction with the printer or other device in which cartridge 1 is installed as will be explained below.

To facilitate and guide insertion of cartridge 1 into the printer, cartridge 1 has a left guide wing 9a and a right guide wing 9b. Guide wings 9a and 9b are thin planes formed as arcs of a relatively large circle, except near the front, where the bottom 9aa is enlarged downward. Guide wings 9a and 9b are mirror images of each other except that, in this particular embodiment described, the left guide wing 9a is wider (extends further laterally) than the right guide wing 9b simply to accommodate the width provided by a particular printer in which the exemplar cartridge 1 is to be installed.

In the embodiment herein described, bottom shutter 7 is pivoted from left-rear cover 31a on a left top actuator link arm 11a and from rear cover (not shown) on a right top actuator link arm 11b, located on opposite sides of shutter 7. Each link arm 11a, and 11b is integral with an actuator 13a, and 13b, respectively, each of which has a rectangular actuator surface 13aa and 13bb, respectively, which extends over the respective guide wings 9a, 9b.

A pivoted lower shutter link 15a and a side of the lower shutter 17a, pivoted to lower link 15a and upper actuator link 11a complete a conventional four bar linkage to provide rotation of shutter 7 in response to rotation of actuator 13a. The rear end of coil spring 19a connects to a lower hook 11aa in link arm 11a to bias shutter 7 closed when the cartridge is not inserted in a printer or other device. The front end of coil spring 19a connects to an upper hole 31aa under actuator 13a. A mirror image of these parts (see FIG. 3) exists on the opposite side, the corresponding part of which will be designated by the same number with "b" letters.

When cartridge 1 is installed in the printer, actuator surfaces 13aa and 13bb are pushed downward by the mating surfaces of the printer to the positions above wings 9a, 9b respectively, as shown in FIG. 1.

Cartridge 1 is inserted by a human operator grasping grips 3a, 3b through holes 3aa, 3bb and moving cartridge 1 in the direction of shutter 5 and toward the rear of the printer (291, FIG. 10) in which it is being installed. A series of upwardly extending ribs 21 spaced along the width of cartridge 1 under grips 3a, 3b, except at holes 3aa and 3bb, provide strength while holes 3aa and 3bb provide room for the fingers of a person to grasp grips 3a, 3b. On the left side is a relatively wide, upwardly extending tab 23. In a preferred

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combination of the embodiment of the invention described herein and an exemplary printer the top of tab 23 interacts with a physical sensing switch in the printer to detect that a cartridge 1 has been installed.

Front cover 25, on which grips 3a, 3b, ribs 21 and tab 23 are integrally formed, is above a separated toner hopper, as will be described. The top cover of cleaner chamber 27 is rearward of shutter 5.

Immediately inside wings 9a and 9b are raised, elongated locator surfaces 29a, 29b to which pressure is applied by a printer to firmly position the toning mechanisms of cartridge 1 when cartridge 1 is installed. Locator surfaces 29a and 29b, wings 9a and 9b, as well as rear cover 31 under wing 9a, are formed integral with cleaner housing 27. Also integral with these elements is front cover 25, having grips 3a, 3b and an outer cover 33 on the left side and generally coextensive in length with the length of front cover 25. Cover 33 has a U-shaped housing 35 at its top. Housing 35 traps spacer stud 37a as will be explained and an assembly hole 39a near the upper front of cover 33 and a spring-holding hole 39b near the lower front of cover 33.

A coupler 41 receives a drive element from a printer which contains an Oldham coupler to rotatably drive the developer roller 43 (not shown in FIG. 1) and toner adder roller 45 (not shown in FIG. 1). To the rear of coupler 41 is the shaft 47 of photoconductor drum 49 (drum not shown in FIG. 1).

FIG. 2 is a perspective view from above and left front of cartridge 1 sectioned near the top to show internal elements. At the immediate front is a large, cylindrical toner hopper 61, having a paddle 63, which, during operation, is rotated clockwise as seen in FIG. 2. Paddle 63 has an outer toner moving bar 63a, which extends across the width of hopper 61 except for a far left section 63aa which is inset as will be explained. The rear wall 61a of hopper 61 when cartridge 1 is installed for operation in a printer terminates at about one-third of the total height of hopper 61 as a flat surface 61aa (specifically, hopper 61 has a 106 mm diameter and the distance vertically from the lowest point of hopper 61 to the horizontal plane coinciding with the highest point surface 61aa of rear wall 61a is 35.3 mm). The upper surface 61aa of rear wall 61a is thin and flat with a slight downward angle from hopper 61 to facilitate removal of the molded part from its mold. An extension 65a from an agitator bar 65 has a depending tab 65b (see FIG. 9) which rests on upper wall 61aa thereby positioning bar 65 slightly above upper wall 61aa. Extension 65a extends past upper wall 61aa to a location at which bar 63a of paddle 63 encounters extension 65a as it rotates. The surface 61aaa opposite surface 61aa from which toner exits is flat and at approximately 50 degrees from vertical (best seen in FIG. 9) when cartridge 1 is installed for operation in a printer.

Vertical ribs 67 located immediately rearward of rear wall 61a are stiffeners for top wall 69 formed about one-third down from the top of hopper 61. The toner moving bar 63a of paddle 63 is closely adjacent to the sides of hopper 61 except where the top of rear wall 61a and the start of top wall 69 form an opening for toner to be delivered rearward from hopper 61 to the toning mechanisms of cartridge 1. This is best shown in FIG. 9.

In FIG. 2, a small part of developer roller 43 to which coupler 41 is directly attached, is seen past ribs 67. Developer roller 43 is parallel to and in contact with photoconductor drum 49. Cleaner chamber 27 has spaced, vertical internal baffles 71, which are strengthening members, as well as members which limit unbalanced accumulation of



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toner in chamber 27. Toner which is not transferred during development is scraped from photoconductor drum 49 by cleaning blade 73, which is mounted to a vertical panel 73a, having a horizontal gusset 73aa to increase strength. As best seen in FIG. 3, panel 73a is mounted to supporting member 75, which has vertical columns 75a (FIG. 2), 75b on opposite sides. Panel 73a is mounted to the vertical columns 75a, 75b by a screw 77a to panel 75a and a screw 77b to panel 75b.

FIG. 3 is a top right side view with further cover elements removed and part of the cleaner removed to illustrate the internal configuration of cartridge 1. A solid, steel-bar doctor blade 91 extends parallel with and in pressure contact with developer roller 43. Blade 91 contacts roller 43 at about 20 degrees from the vertical toward toner adder roller 45. Also shown in FIG. 3 are metal electrical contact 93 to doctor blade 91, metal electrical contact 95 to toner adder roller 45 and metal electrical contact 97 to developer roller 43. The outer ends 93a, 95a, 97a of the contacts bear against metal contacts in the printer when cartridge 1 is installed and thereby make electrical contact to receive electrical potentials from the printer.

The developing system of cartridge 1 is essentially very similar to that of the Opra brand family of printers sold by the assignee of this invention. As in that family of printers, toner adder roller 45 is a conductive sponge material attached to a steel shaft and developer roller 43 is semiconductive material attached to a steel shaft. When cartridge 1 is installed for operation in a printer, cartridge 1 is oriented generally as shown in FIG. 3 and the horizontal plane containing the lowest surface of toner adder roller 45 is 22.6 mm above the lowest point of hopper 61.

Toner adder roller 45 and developer roller 43 are journaled in the rearward extensions 99a and 101a (FIG. 4) of the end members 99 and 101 (FIG. 4) of hopper 61. Agitator 65 has a bent portion 65aa to become parallel to extension 99a where it is pivoted to extension 99a on pin 103a. As paddle 63 rotates, bar 63a contacts extension 65a, thereby rotating agitator 65 around pin 103a upward. Agitator 65 then returns to near rear wall 61a under the force of gravity to dislodge toner, which otherwise tends to accumulate on exit surface 61aaa (see FIG. 9).

FIG. 4 is a top right rear view with cover elements removed showing more fully the end members 99 and 101 of hopper 61 and their extensions 99a and 101a. Integral with end member 101 is spacer stud 37b. Under and to the front of stud 37b is spring mounting post 131b, which mounts one end of spring 132b, the other end of which is mounted on hole 242 (best seen in FIG. 20).

Also integral with end member 101 is perpendicular shield wall 133, which extends downward and rearward to present a barrier to physically protect encoder wheel 135. The bottom portion of wall 133 forms a flat contact surface 133a to receive a locating roller from the printer when cartridge 1 is installed. Encoder wheel 135 is linked to paddle 63 through a paddle gear assembly 163 having a torsional yield member (FIG. 5) so as to provide information as to the amount of toner in hopper 61 to the printer on which cartridge 1 is installed by the sensing of the location of windows 135a. Additionally, other windows 135b provide other information, while wider window 135c provides a home location reference. Light blocking selected labels 136 are located between windows 135b and 135c and block windows of a series of windows 135b to thereby customize information onto wheel 135. The details and operation of encoder wheel 135 are described in U.S. patent application

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Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169, entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device" and form no contribution to the invention of this specification.

FIG. 4 also shows electrical contacts 93, 95 and 97 as they are supported by floor 137 which extends perpendicularly from hopper extension 101a. Vertical ribs 139 extend from floor 137 between contacts 93, 95 and 97 to strengthen the floor 137.

Mounting roller 141a is journaled to hopper extension 99a and symmetrical mounting roller 141b is mounted to hopper extension 101a. Rollers 141a and 141b contact inside surfaces of the cover of cartridge 1, as will be described. Surfaces 133a and 161a (FIG. 5) of hopper 61 rests on rollers in the printer as will be further described.

Hopper end member 101 has an opening receiving a closely-fitting, resilient, cylindrical plug 143. Prior to installing plug 143, toner is loaded into hopper 61 through the open hole, then plug 143 seals the hole.

Photoconductor roller 49 has at its right end a transfer roller drive gear 145, which drives a roller in the printer when cartridge 1 is installed in the printer.

FIG. 5 is a top left rear view with cover elements removed showing more fully the outside of members 99 and 99a of hopper 61. Integral with end member 99 is spacer stud 37a. Under and to the front of stud 37a is spring mounting post 131a, which mounts one end of spring 132a, the other end of which is mounted in a hole in member 431 (FIG. 19), which is an inner extension of cover 33 (FIG. 2).

Also integral with end member 99 is perpendicular shield wall 161, which extends downward and rearward to a barrier to physically protect torsional paddle gear assembly 163. The bottom portion of wall 161 forms a flat contact surface 161a to receive a locating roller from the printer when cartridge 1 is installed. The details of paddle gear assembly 163 are not part of this invention and are more fully disclosed in the above-mentioned patent application Ser. No. 08/602,048, now U.S. Pat. No. 5,634,169.

Gear 49a, integral with the end of photoconductor drum 49, receives power from a meshing gear in the printer when cartridge 1 is installed in the printer. Coupler 41 is integral with developer roller 43 and drives idler gear 165, which drives toner adder roller 45 (FIG. 3) by being meshed with gear 167, which is integral with toner adder roller 45. Coupler 41 receives power from a driver in the printer which is separate from the drive to drum 49, although preferably from a single motor in the printer.

Gear 167 drives the large gear of compound gear 169. Gear 169 drives the large gear of compound gear 171, and gear 171 drives paddle gear 163. A gear plate 173, mounting gears 165 and 169, is mounted on hopper extension 99a by mounting screw 175.

FIG. 5 shows the end of agitator 65 opposite that shown in FIG. 3. That end has a bent portion 65bb to become parallel to extension 101a of end member 101 when it is pivoted to extension 101a on a pin 103b.

Continuing the detailed description of the cartridge incorporating a preferred embodiment of the present invention, FIG. 6 is a top right rear view sectioned near the top similar to the sectioning of FIG. 2. FIG. 6 illustrates more clearly the mounting of doctor blade 91 mounted to press on developer roller 43 under the bias of leaf spring 191. Blade 91 is located on the left rear by tab 361 (best seen in FIG. 14), and on the rear by extension 196a (FIG. 12) of hopper end



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member 99 which form front and back barriers for holding the left side of doctor blade 91. Similarly, on the right side, two surfaces from 101a, including a rear extension 365 (best seen in FIG. 13) and a front extension 366 (FIG. 13) form front and back holding the right side of doctor blade 91, symmetric to the cage holding the left side of doctor blade 91. The top of blade 91 is held by spring 191. An adhesive tape 192 across the top of the doctor blade 91 bridges over the adjoining horizontal edge of wall 69 (FIG. 2) for sealing, as is conventional.

Spring 191 has blunt ends 191a and 191b, spaced from the center, which contact blade 91 to bias it downward on to developer roller 43. A central ledge 197, integral with ribs 67, forms a cavity receiving the center of spring 191. Horizontal ledges 199a and 199b, opposite central parts of spring 191, formed integral with ribs 67, are horizontal barriers to prevent spring 191 from moving toward the front. Preferably, so as to permit rough handling of cartridge 1 which might occur during shipment, solid upper stop members (not shown) are attached by double sided adhesive on each side between ledges 199a and 199b and the sides 99a and 101a, respectively. These are spaced 0.18 mm above the top of blade 91 and, therefore, contact blade 91 only during rough handling.

FIG. 6 also illustrates posts 141aa and 141bb, which are molded as extensions of members 99a and 101a, respectively, and supporting mounting rollers 141a and 141b, respectively (FIG. 5).

FIG. 7 is a bottom left front depiction of cartridge 1 viewed externally. A series of horizontal depressions 221 along the back of hopper 61 provide a roughened surface for thumbs when fingers grasp the cartridge through opening 3aa and 3bb. A series of relatively long vertical ribs 223 integral with the bottom of hopper 61 serve as paper and other media guides, while a series of shorter ribs 225, located rearward of the start of ribs 223 and between ribs 223, prevent media snags as media encounter photoconductor drum 49, located immediately after ribs 223 and 225. Past drum 49, media encounter further media guide ribs 227 located on the bottom of shutter 7. FIG. 7 also affords a clear view of idler gear 165 and gear 167.

FIG. 8 is a bottom right rear depiction of cartridge 1 viewed externally. This shows the full right guide wing 9b with enlarged front part 9bb. FIG. 8 shows the right cover elements which were deleted in FIG. 6. A front lower cover section 241 is over much of the encoder wheel 135 and has an access hole 243 for ease of assembly and has an access opening 244 (best seen in FIG. 20). Cover section 241 is stepped outward a small amount to provide room for spring 132b (FIG. 20) to extend between post 131b (FIG. 4) and hole 242 (best seen in FIG. 20). Generally, above and forward of and integral with cover section 241 is cover section 245, which is over the remaining upper front of cartridge 1. Section 245 has a U-shaped housing 247 at its top which traps spacer stud 37b. In the rearward part of section 245 opposite the area above photoconductor drum 49, are located rectangular channels 249 with the second rectangular channel 249a and the last rectangular channel 249b being open to pass air for cooling photoconductor drum 49 during operation of cartridge 1.

The far rear portion 251 of this particular embodiment of the invention herein described mounts links 11b and 17b to shutter 7. A bottom section 253 of the cover located under and forward of passages 249a and 249b mounts the shaft 47 of photoconductor drum 49 and has two upper symmetrical vent holes 255a and 255b to pass air for cooling drum 49.

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FIG. 9 is a front right perspective view of the molded plastic member housing 271 which forms the central portion and central extension of hopper 61 with end member 99 attached and agitator 65 installed. It is seen to form a cylindrical chamber with an exit opening formed between wall 69 and wall 61a. An inset 273 at the bottom rear of hopper 61 provides space for rollers in the printer. As best seen in FIG. 2, paddle bar 63a has an inset far left section 63aa to clear inset 273.

Member 271 has a slot 275 around its right side. A directly similar slot is around the left side. End member 101 has a mating ridge 321 (FIG. 13). During manufacture slot 275 is mated with ridge 321 in end member 101 and the two are welded together with ultrasonically created heat. Member 99 is welded to the left side of member 271 in the same manner with ridge 322 (FIG. 12) inserted in a mating slot (not shown) on the left side of member 271.

A notch 277 above agitator extension 65a allows for sufficient rotation of agitator 65 to allow paddle arm 63a to pass beyond extension 65a while preventing a full turn-over of agitator 65.

#### Developer Assembly

The housing 271 and its attached end members 99 and 101, form toner hopper 61. Extension 101a journals toner adder roller 45 and developer roller 43. Gear plate 173, which is attached to extension 99a by screw 175, journals the opposite ends of toner adder roller 45 and developer roller 43. Accordingly, a single unitary assembly is formed of the hopper 61 rearward to and including developer roller 43.

#### Photoconductor and Cover Assembly

Front cover 25 grips 3a, 3b, left outer cover 33, rear wall 31, (FIG. 1) right cover sections 241, 245, and 251, (FIG. 8) wings 9a, 9b and cleaning chamber 27 are a single molded part. Photoconductor 49 is journaled in this part with its shaft 47 extending past the covers on opposite sides. Shutter 7 is movably supported to left cover 31 and right rear cover 251. Accordingly, a single unitary assembly is formed of the cover members, the photoconductor drum 49 and the shutter 7.

In use, springs 132a and 132b pull the developer roller 43 against the photoconductor drum 49 at a predetermined tension. When cartridge 1 is picked up, the developer assembly and the photoconductor and cover assembly rotate under gravity until stud 37a (FIG. 1) contacts housing 35 and stud 37b (FIG. 8) contacts housing 247, thereby holding the two assemblies together.

#### Lower Shutter as Heat Barrier

Lower shutter 7, when open, covers all of the lower surface of the cleaner chamber. The material of shutter 7 is polycarbonate, a material which deflects heat from the fixing operation which occurs after paper is moved rearward from contact with the photoconductive drum 49. The material of the body of the photoconductor and cover assembly, the hopper 61, end members 99 and 101, and shutter 5 are polystyrene which is lower in cost than polycarbonate would be. The added cost of shutter 7 being polycarbonate is justified by shutter 7 providing heat protection to the cleaner 27 which allows that member to be polystyrene.

#### Agitator Bar System

The toner of cartridge 1 is monocomponent, which can become stagnant and cohesive when left undisturbed for a

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time. This stagnation and settling of toner may be aggravated by the slight vibrations generated by the printer motor and gear train in a laser printer.

Failure to deliver toner from wall 61a via sloped exit surface 61aaa is the consequence of the settling, stagnation, and cohesive nature of the monocomponent toner in hopper 61. The angle of repose of the settled toner (i.e., the angle of tilt of a surface on which the settled toner rests before it "falls" under its own weight) can reach or exceed 90 degrees. The exiting surface 61aaa is tilted upward at approximately 50 degrees from vertical during operation (angle A, FIG. 9), allowing the toner to stagnate into a pile that does not reach the toner adder roller 45. This leads to premature failure to print, termed "starvation," as would result using an empty cartridge. Experimentally, as much as 230 grams of the 465 gram capacity of hopper 61 of toner have been found in the hopper 61 of a cartridge 1 when starvation has occurred due to existence of a stagnant pile of toner preventing toner delivery to toner adder roller 45.

Agitator bar 65 overcomes toner stagnation and failure to deliver toner to toner adder roller 45. The primary function of agitator bar 65 is to prevent toner stagnation and to deliver toner from the entrance of the developer sump to the toner adder roller thus preventing premature failure to print.

As the hopper paddle 63 rotates counter-clockwise (FIG. 3), it reaches a point in its rotation where it begins to contact extension 65a and lift agitator bar 65. Paddle 63 continues to lift agitator bar 65 until it loses engagement with extension 65a. At this point, the agitator bar 65 falls back via gravity to the resting position, carrying toner from the entry of the developer chamber to the toner adder roller. (Although not useful on the disclosed embodiment, an alternative is a pad on extension 65a or on upper wall 61aa which will cushion the fall. Such a pad would also serve as a spacer to control the position of the agitator in the down position and eliminate tab 65b).

At the top of its travel the agitator bar 65 is out of the way of the main sump paddle 63 and approaches a notch 277 in the hopper housing 271 (FIG. 9). Notch 277 provides space for the agitator bar 65 to clear the end of hopper paddle 63, and prevents overtravel of the agitator arm 65, which could cause locking into an up position when the cartridge is shipped, stored, or handled outside of the machine.

In the up position, the agitator bar 65 forms a nearly vertical wall over hopper wall 61a. The initial opening above wall 61a is about 26.7 mm, while the height of bar 65 facing that opening is 7 mm. This allows room for toner from the main sump to flow between the agitator 65 and sloped wall 61aaa. It also serves as a temporary barrier to prevent the delivery of excessive amounts of toner from the hopper 61 to the toner adder roller 45. As the agitator bar 65 falls to its resting position, both newly delivered toner and any stagnant toner resting on wall 61aaa are pushed toward the toner adder roller 45. The motion of the agitator 65 also stirs toner in the area above and toward developer roll to doctor blade nip 91, helping to prevent packing and stagnation of toner in this volume.

The agitator 65, preferably can be implemented by stamping (or laser cutting) and can be formed from sheet metal with spring characteristics that maintain agitator shape during assembly and operation. The entire part comprising bar 65, extension 65a and bent portions 65aa and 65bb preferably can be made by stamping out all features in one operation. As envisioned for the preferred embodiment, illustrated herein, bar 65 may have a length approximately equal to the toner adder roller length, which may be, for

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example, 220 mm; and have an exemplary height of approximately 7 mm; a thickness of 1.3 mm, chosen to give an agitator mass of the entire part stamped of, for example, approximately 20 grams. Since agitator bar 65 is driven by gravity, the mass is chosen to provide a driving force sufficient to push stagnant toner along wall 61aaa to toner adding roll 45, but the mass is limited so as not to affect the torque sensing function of the hopper paddle 63.

Hinge segments 65aa and 65bb and the associated distance from pins 103a and 103b to agitator bar 65 determine the arc swept by bar 65 as it falls from the up position to the down position. In the present preferred embodiment, pivot distance of 13.5 mm, for example, allows the paddle to sweep from an up position which leaves a gap of 3 mm between the bottom of the bar 65 and the wall 61aa, to a down position 3 mm above the toner adder roller 45. With this design, the weight of the paddle is effectively applied to move toner over the distance swept by the arc. A shorter pivot distance would result in insufficient travel to capture and deliver toner; and would require a heavier paddle to exert the same force on the toner over the distance swept through the arc. Pins 103a and 103b are smaller in diameter (1 mm, for example) than their holes in which they fit in portions 65aa and 65bb to prevent binding due to toner buildup.

Extension 65a is long enough to engage the active segment of paddle 63. Additionally, the length of extension 65a is long enough to overlap the active segment of paddle 63 when extension 65a first engages the paddle 63 to prevent scraping of the paddle surface. A small radius (0.5 mm, for example) is placed on the bottom tip of extension 65a to prevent scraping of paddle 63 as it releases extension 65a.

The overall length and elasticity of the agitator 65 allows assembly over pins 103a and 103b by simply deflecting the part.

Accordingly, this agitator design functions to overcome toner stagnation and to deliver toner from the entry of the hopper 61 to the toner adder roller 45 active area. The agitator 65 and its extensions 65a, 65aa and 65bb are a single part. Agitator bar 65 is driven internally, with no external gearing, cams, or seals as would be required by an externally driven agitator. Thus gear cost and complexity, seals, friction, and toner leaks are eliminated as problem areas. Agitator 65 is activated frequently enough to move toner and prevent stagnation without adding excessive stirring or damage to the toner. This design enhances first-in, first-out toner delivery from hopper 61 to the smaller area containing the toner adder roller 45 by preventing excessive toner delivery in the raised position and discouraging return toner from the area of the toner adder roller 45 to the hopper 61.

#### Dimensions

With the cartridge installed for operation, the location of the nip of toner adder roller 45 with developer roller 43 is at 105 degrees from vertical. The nip angle of the photoconductor drum 49 to the developer roller 43 is 95 degrees from vertical. As previously stated, the doctor blade nip is at 20 degrees from the vertical.

The length from the bottom of hopper 61 to the horizontal plane coinciding with the edge of top surface 69 near hopper 61 is 61.96 mm, creating an initial opening of about 26.7 mm (as indicated previously, bottom surface 61aa is at 35.3 mm). Top surface 69 has a slight upward angle to a tallest point of 64.34 mm.

The diameter of toner adder roller 45 is 14 mm and it is located with its circumference 1 mm above the bottom of

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hopper body 271 immediately below it. The diameter of developer roller 43 is 20.11 mm and it is located with its circumference 2 mm above the bottom of hopper body 271 immediately below it. The length from the bottom of hopper 61 to the horizontal plane coinciding with the bottom of developer roller 43 is 23.7 mm, and the corresponding length to the bottom of the toner adder roller 45 is 22.6 mm. The diameter of photoconductor drum 49 is 30 mm.

The bottom of body 271 under rollers 43 and 45 is at a 6 degree upward angle to provide sufficient room for guide ribs 225 on the outside of body 271.

#### Installing the Cartridge

FIG. 10 is a left front view of the inside of a printer with which the inventive cartridge herein described by way of an exemplary preferred embodiment may be used. The cartridge 1 is installed in a printer 291 (FIG. 10) from the front to a final position well within the printer 291. To achieve this, guide wings 9a and 9b are initially guided by a lower track 293 over a curved track, which guides cartridge 1 under the laser printhead (not shown) and over paper feed elements 295.

The path is downward, which utilizes gravity while inserting cartridge 1, thereby easing insertion. The guide 293 (and a guide not shown, which is a mirror image of guide 293 on the opposite side of printer 291) has the same curvature as wings 9a, 9b so that the wings 9a, 9b can follow guide 293 and its opposite guide.

Upper guide 297 is parallel to guide 293. Guide 297 extends further into the printer than guide 293. A guide (not shown), which is a mirror image of guide 297, is on the opposite side of printer 291. Guide 297 encounters actuator surface 13bb early during the insertion of cartridge 1. As cartridge 1 is moved rearward, actuator surface 13bb is rotated to open shutter 7 (as is surface 13aa rotated by encountering a mirror image of guide 297 on the left side of the printer). This early movement of shutter 7 is very advantageous in that it eliminates the need for space and mechanism which would be required if actuation occurred at the end of insertion of cartridge 1.

Also shown in FIG. 10 is the right reference position roller 299 on which contact surface 133a rests when the cartridge is inserted. Contact surface 161a will rest on an identical roller (not shown) on the opposite side of printer 291. Rearward of roller 299 is V-block 301, shown more clearly in FIG. 11, and an associated electrical contact 302. Further rearward is an upstanding lug 303, which will contact shutter 7 to hold it open as will be described.

As cartridge 1 is inserted, wings 9a, 9b are guided by guides 293 and 297 and the mirror image guide (not shown) on the opposite side of printer 291. As insertion continues, the wings 9a, 9b fall off the lower guide 293 (and its mirror image guide) and the shaft 47 of photoconductor drum 49 drops into V-block 301 and a mirror image V-block (not shown) on the opposite side of printer 291. A depending thin metal sheet 302 (FIG. 11, shown in side view) is contacted and bent somewhat by shaft 47 as it is guided by V-block 301. This creates a connection for operating potential to shaft 47. When cartridge 1 falls into V-block 301, lug 303 contacts shutter 7 to hold shutter 7 open. Prior to that the longer length of upper guide 297 was sufficient to hold shutter 7 open.

In this final position cartridge 1 is more precisely located with respect to functional elements. Cartridge 1 is held in printer 291 as described below under the heading "Reference Surfaces."

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To remove the cartridge, it is grasped by grips 3a, 3b and pulled sharply upward and forward. Wings 9a and 9b again enter between guides 293 and 297, and the cartridge can be pulled free.

#### Manufacture of Cartridge

All molded parts follow the technical dictate (to avoid distortion on cooling) of keeping adjoining surfaces the same thickness. Accordingly, molded studs seen from the rear (shown, for example, in FIG. 13) appear as holes in the part. Circles in the drawings with bowed lines crossing indicate the gate where molten resin was received into the mold (shown, for example, also in FIG. 13).

Assembly of cartridge 1 begins with the joining of hopper body 271 to its end members 99 and 101 with paddle 63 installed. The inside of end member 99 is shown in FIG. 12 and the inside of member 101 is shown in FIG. 13. Both are molded parts of polystyrene resin. Each of the members 99 and 101 is mated to its corresponding side of body 271 (FIG. 9). Ridge 321 of member 101 enters slot 275 on the right edge of member 271. Ridge 322 of member 99 enters slot (not shown) on the left edge of member 271 mating ridge 322. Those parts are held tightly in a fixture and ultrasonically welded, with paddle 63 inserted before the last of the two end members is welded. Then a bushing (not shown) is press fit into the central hole 325 of member 101 around the shaft of paddle 63 and a second bushing (not shown) is similarly press fit around the shaft of paddle 63 in central hole 329.

Agitator bar 65 (FIG. 9) is then flexed and installed by mounting end portion 65aa on pin 103a and end portion 65bb on pin 103b.

Toner adder roller 45 with low friction washers on each end is then installed by angling its shaft through hole 333 (FIG. 12) in member 99, straightening, and then moving roller 45 laterally to bring its shaft through a press fit bushing (not shown) in hole 335 in member 101.

Prior to installing toner adder roller 45 and gear plate 173, a sickle-shaped seal member having a semicircular central body (not shown) is installed on each side of the location of developer roller 43. Such a seal is illustrated in IBM Technical Disclosure Bulletin, Vol. 33, No. 3B, August 1990, pp. 29-30, entitled "Toner Seal for Printer." The location of this seal on the right side is labeled surface 383 in FIG. 13. This is essentially standard as putty is first applied on each end of the location for the seal and the ends of the compliant elongated seal are pressed into the putty. The seal has ridges directed slightly toward the center. A seal system such as this is essentially the same as previous cartridges.

Doctor blade 91 (best seen in FIG. 6) is then installed by bringing it vertically upward behind ridge 365 (FIG. 13) on the right. In the completed cartridge 1 blade 91 is held on the bottom by contact with developer roller 43. Developer roller 43 with low friction washers on each end is installed by positioning the left end of its shaft past end member 99 (FIG. 12) and threading the right end of its shaft through the central hole of the bushing 375, shown in FIG. 15.

Gear plate 173 is shown alone in FIG. 14. It has a hole 351 to receive the shaft of toner adder roller 45 and hole 359 for shaft of developer roller 43. A central hole 353 is to receive screw 175 but hole 353 is significantly larger than the shaft of screw 175. Gear plate 173 has a shaft 355, a shaft 357, and a rightwardly extending tab 361.

Gear plate 173 is brought toward member 99 while the shafts of toner adder roller 45 and developer roller 43 are



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positioned through holes 351 and hole 359 respectively. Gear plate 173 is rotated until tab 361 abuts the edge of doctor blade 91. This serves as a locator for gear plate 173 and doctor blade 91. Screw 175 is then tightened in hole 353 to fix plate 173 in that position.

Gears 169, 165 and 171 are pressed on shafts 355, 357 and 363 (FIG. 5, on member 99). (As is shown in FIG. 14, such shafts have an enlarged head with a gap so as to be yieldable when receiving a press-on force.) A gear 167 is also pressed on the shaft toner adder roller 45. Paddle gear assembly 163 is pressed onto the shaft of paddle 63. These gears and drive coupler 41 are keyed to their shafts by the two having matching "D" cross sections.

Bushing 375 has a flat outside segment 377 which permits bushing 375 to enter opening 379 (FIG. 13) in member 101 since opening 379 is circular with an open less-than-one-half circle segment in which bushing 375 can fit at one orientation. Bushing 375 is then rotated in a direction to rotate lower tab 381 downward, which removes the orientation at which bushing 375 can fit through the incomplete segment of 379 and locks bushing 375 into place. Bushing 375 installed is shown in FIG. 16. In operation, developer roller 43 rotates in a direction to rotate tab 381 downward. The advantage of bushing 375 is that it provides for relatively easy installation and change of developer roller 43 in the event that a member requires replacement during subsequent tests.

Drive coupler 41 is then press fit on the left end of the shaft of developer roller 43 using a locating shim to space coupler 41 slightly from cover 31. Mounting rollers 141a and 141b are previously applied by press fit during completion of the hopper 61. An adhesive tape is applied across the top of doctor blade 91. Spring 191 is then flexed into place to bias doctor blade 91 downward. After toner is installed and leak tested, the previously mentioned upper stop members on each side of ledges 199a and 199b are applied individually and remain in place, held by their back adhesive layer. Also encoder wheel 135 is installed by press fit.

With rollers 43 and 45 and doctor blade 91 in place, metal contact 93 is inserted between ribs 139. Contact 93 has arrowhead sides to bind into ribs 139, and extends upward and over two posts 385 (FIG. 4) in member 101a and extends to a bent end which presses against doctor blade 91. Contacts 95 and 97 similarly have arrowhead sides which dig into ribs 139 and terminate in short bent ends 387, 389, respectively, which press against the shafts of roller 45 and 43, respectively. Contact grease is added to contacts and shafts.

The foregoing all are part of the developer assembly. The photoconductor and cover assembly is separately assembled. The cleaner blade panel 73a (see FIG. 3) is installed using screws 77a and 77b. Link arms 11a, 11b, 17a, 17b and 15a, 15b are assembled in a known manner by studs having extensions which enter matching holes in adjoining arms. The arms are then are rotated to operating positions in which the extensions find no opening and therefore lock the members together while leaving them free to rotate. Links 13a to 11a and 13b to 11b are held by a pin 401 with latch, as shown in FIG. 17.

Pin 401 has a circular flexible arm 403 and latches 11a and 1b have a matching ledge 405b (the ledge on the opposite side not shown). Pin 401 is inserted through the holes of member 13a and 11a and another pin 401 is inserted through the holes of members 13b and 11b. The pins 401 are then rotated until their arms 403 flex around ledge 405b and the ledge on the opposite side, respectively, and then recover

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to latch under ledge 405b and the ledge on the opposite side, respectively. This holds both four bar linkages in place. Pin 401 has a shaft 407 (best seen in FIG. 4), which extends into a groove (not shown) on each side of cleaner 27 for added stability of each four bar linkage.

Shutter 7 is installed by flexing shutter 7 and locating pins 431b (FIG. 1) and a pin on the opposite side (not shown) and inserting pin 431b and the pin on the opposite side in holes in the sides of locator surface 29a, 29b, respectively. Pin 431b has a coil compression spring 433 wrapped around it which is tensioned to bias cover 7 upward.

As best seen in FIG. 19, one end of spring 132a is attached through a hole of connector tab 431 of cover 33 on one side and the opposite end of spring 132a is temporarily attached to hole 39a of cover 33. As seen in FIG. 20, spring 132b is attached through a hole of connector tab 242 of cover 241 on one side and the opposite end of spring 132b is temporarily attached to hole 243 of cover 241.

The photoconductor drum 49 is installed into the cleaner housing assembly by placing the drum and the two gears 49a and 145 (see FIGS. 4 and 5) in position with a thin washer, (not shown) on the left side and inserting shaft 47 through that assembly and the housings 31 (FIG. 2) and 253 (FIG. 8). Standard E-clips are installed on each end of shaft 47 to hold the drum and shaft from lateral movement. As shown in FIG. 18, an extending hub 145a of gear 145, has an internal copper sheet 421 with three sharp points 421a. Copper sheet 421 also has an elongated member 421b extending to over the central hole. Hub 145a is inserted inside drum 49. Points 421a dig into the aluminum cylinder which forms the inside of drum 49, creating both physical and electrical connection. Shaft 47 is then threaded through gear 145, drum 49 and then through gear 49a. This bends elongated member 421b so that it presses against shaft 47 and makes electrical contact.

The developer assembly is then placed before the photoconductor and cover assembly and the two are moved together. Covers 33 and 241, 245 flex outward and then close into the final position. Springs 132a and 132b are removed from holes 39a and 243 and manually attached to studs 131a and 131b respectively. This completes the cartridge 1.

It will be readily understood that any joint where toner is contained must be sealed. Immediately inside the bearings of toner paddle 63 and toner adder roller 45 synthetic rubber end seals are located. FIG. 13 shows a socket 335 having upper and lower tabs which receive such a seal, the seal having matching extensions which fit in the tabs to prevent rotation of the seal. The ends of the chamber of cleaner 27 have foam walls with outer adhesive to secure their positioning. As is previously known, other extended joints have a plastic (polyethylene terephthalate) tape with one side carrying pressure sensitive adhesive applied along them by the adhesive. As is also previously known, developer roller 43 is sealed with a tape which is cantilevered up from the bottom of body 271 to be located in front of the roller 43. A second adhesive strip seals the far rear edge of body 271. Such sealing is basically standard and forms no part of this invention.

#### Toner

In a preferred embodiment cartridge 1 employs mono-component electrophotographic toner which may be basically conventional. The amount of toner in hopper 61 is limited by pressure impairing print quality and sensing of toner level by toner resistance on paddle 63. When cartridge 1 is in the installed position, a typical top level of toner will be 10 mm above the upper barrier wall 61aa. The presence

of toner at that typical highest level is indicated in FIG. 9 by surface lines 425, but the toner is shown otherwise as transparent for clarity. The actual toner is, of course, an opaque, dry powder. During use, the toner is depleted to lower levels and it is moved by paddle 63. As is conventional, developer roller 43 applies toner 425 to photoconductor drum 49 to develop electrostatic images on photoconductor drum 49.

#### Reference Surfaces

FIG. 19 shows just the roller 141a of the hopper assembly as finally installed and, therefore, located on a flat surface 441 which is an extension of the cover 33. Similarly, FIG. 20 shows just the roller 141b of the hopper assembly as finally installed and therefore located on a flat surface 443 which is an extension of cover 241. Such positioning of an assembly with the photoconductor roller and an assembly with the developer roller for lateral adjustment for rollers is essentially the same as in prior cartridges.

However, in the described embodiment of the present cartridge, cartridge 1 has flat surfaces 133a and 161a and the printer 291 has the second set of rollers (roller 299, FIG. 10 and its mirror image), on which flat surfaces 133a and 161a, respectively, rest. In the prior cartridges a second set of rollers was part of the cartridge. As in the prior cartridges the two sets of rollers 141a, 141b, 299, and the mirror roller image of 299, define a plane of movement to guide the developer roller 43 into the intended contact with photoconductor drum 49.

FIG. 19 shows tab 23, which is an extension of cover 33 and, when the cartridge 1 is installed in a printer as shown in FIG. 19, is generally above a flat surface 445 of the frame of the printer. Similarly, as shown in FIG. 20, a top flat ledge 447 is an extension of cover 241 and, when cartridge 1 is installed in a printer, is above a flat surface (448 of FIG. 10) of the frame of the printer.

A flat bottom surface 449 (FIG. 19) is under tab 23 of cover 33, and a flat bottom surface 451 (FIG. 20) of cover 245 is under ledge 447. Bottom surfaces 449 and 451 are locator surfaces which rest on frame surfaces 445 and 448, respectively.

FIG. 21 shows the right side of cartridge 1 installed in a printer with emphasis on cantilevered roller 461 pressing down on locator surface 29b. A second cantilevered roller (not shown), which is a mirror image of roller 461 exists and presses down on locator surface 29a. Roller 461 and its mirror image roller are attached to the frame of the printer. They are firmly biased downward by a coil spring 463 for roller 461 and a mirror image coil spring for the mirror image roller. As the cartridge 1 is inserted in the printer by movement of wing 9a in guides 293, 297 and wing 9b in corresponding mirror image guides, locator surface 29b encounters cantilevered roller 461 and locator surface 29a encounters a corresponding mirror image cantilevered roller; and the locator surfaces 29a, 29b rotate those rollers upward as the cartridge 1 continues to move.

When wing 9a falls off of guide 293 and is finally positioned by shaft 47 settling in V-block 301, cantilevered roller 461 fully contacts surface 29b, as shown in FIG. 21. When the top cover of the printer is closed, a downwardly positioned leaf spring on the printer cover contacts tab 23 on the left front of cover 33 and a second downwardly positioned spring on the printer cover contacts surface 447 on right cover 241. Such interaction of a cartridge with a printer lid is generally conventional, as illustrated by U.S. Pat. No. 5,365,315 to Baker et al.

As the printer lid is closed, a charge roller mechanism is moved to shutter 5 and then continues to move downward to open shutter 5 by pushing it downward and to bring a charge roller in contact with photoconductor 49. A laser beam for discharging drum 49 is also directed through the opening left after shutter 5 is pivoted down, as is shown on U.S. Pat. No. 5,526,097 to Ream.

In summary, the photoconductor and cover assembly is located downwardly by front surfaces 449 and 451, is located downwardly by shaft 47 in V-block 301 and in the mirror image V-block and is held in the downward location by cantilevered roller 461 on surface 29b and the mirror image cantilevered roller on surface 29a. The developer assembly is located laterally by springs 132a and 132b moving the assembly so that developer roller 43 contacts the photoconductor 49, and is located downwardly by ledge 133a resting on roller 299 and ledge 161a resting on the mirror image roller to roller 299. The developer assembly requires no upward locator as it has sufficient weight not to displace upward.

Ledges 133a and 161a resting on roller 299 and a mirror image roller respectively permit the developer assembly to adjust laterally. In prior cartridges, both sets of rollers were in tracks in the cartridge. This required difficult tolerances to locate the bottom of the cartridge within the printer. In the subject cartridge, ledges 133a and 161a have no linked parts to the media guide ribs 223 and 225, which are in the same molded part as ledges 133a and 161a.

FIG. 22 shows an extension of side member 99 held in a slot 471 in the bottom of the cover 25. This provides lateral location between the hopper assembly and the cover 25. Generally similar lateral location structure is in previous cartridges. If desirable, the upper parts of end members 99 and 101 and have an upward ridge or bump, which will strike cover 25 during rough handling and thereby limit relative upward movement of the hopper assembly with respect to cover 25.

When installed in the printer, frame members contact left cover 31 and right cover 241 to assure they do not contact the hopper assembly and interfere with its free movement over roller 299 and its mirror image roller on ledges 133a and 161a respectively.

#### Venting By Plug

Plug 143 (FIG. 24) in a preferred form is a venting element which allows air to escape cartridge 1 while blocking toner. Cartridge 1 in the embodiment disclosed is designed to operate at high speed to print from 8 to 24 or more standard pages per minute. This operation generates a potentially detrimental internal pressure level during operation, which contributes to leaks of toner from cartridge 1. To relieve such pressure, plug 143 is a labyrinth design ending in a felt filter.

The leaks often, but not exclusively, occur immediately after the cartridge becomes inactive. Internal pressure in hopper 61 is created by ingesting air with toner 425 carried by the developer roller 43 past a seal (not shown) under the developer roller 43. The toner adder roller 45 pulls this air/toner mixture away from the developer roller which creates a pressure increase in hopper 61 until an equilibrium pressure is reached. As shown in FIG. 23, plug 143 is formed from a single molded part 481 having a circular base member 483 and a circular cap member 485 separated by a thin connecting arm 487, which has a central notch 489 to permit bending as a solid hinge.

Base 483 has a series of equally separated external holes 491 around the entire bottom circumference of base 483.

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Extending from the bottom of base 483 and located inward is a circular wall 493 having spaced rectangular openings 495 at the outer end of wall 493 equally spaced around the entire circumference of wall 493.

Similarly, cap 485 has a circular wall 497 extending from the top of cap 485 having spaced rectangular openings 499 at the outer end of wall 497 equally spaced around the entire circumference of wall 497. A disk 501 of standard F3 felt is pressed into the center of cap 485 where it contacts the inside of holes 503 (FIG. 24) in the center of cap 485.

To complete plug 143 as shown in FIG. 24, cap 485 and base 483 are intermeshed by folding arm 487 at hinge point 489. In this position no part of openings 499 is opposite external holes 491 and no part of openings 495 is opposite holes 499. FIG. 25 is a staggered cross section view of FIG. 24 which shows all of the holes 495 and 499 and indicates the staggered path by the angles 505a and 505b in discussion arrow 505.

As shown in FIG. 25, the plug is held together by a press fit in which the bottom circumference of base 483 is slightly smaller than the circumference of cap 485. In operation, when pressure increases in cartridge 1, air, potentially containing toner particles, enters openings 491 which are inside of hopper 61. That air enters circular chamber 507, as illustrated by arrow 505, and is blocked by wall 497 immediately opposite hole 491 and, therefore, must move right or left, as illustrated by bent arrow 505a, to reach openings 499. The air then enters chamber 509. That air is blocked by wall 493 and also must move right or left, as illustrated by bent arrow 505b, to reach openings 495, which are on the opposite end of chamber 509. Upon passing through openings 495, as shown by arrow 505, the air enters central chamber 511 and passes through felt filter 501 and then out of cartridge 1 through holes 503. (FIG. 23 shows four central flanges 513a-513d, which divide chamber 511 into four equal parts. However, flanges 513a-513d are for structural support of felt disk 501 and, functionally, chamber 511 can be a single chamber.)

The labyrinth configuration of this construction of plug 143 results in continuing operation as an air vent with only

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minor accumulation of toner inside of the plug 143. The internal chambers 507, 509 and 511 are concentric circles.

We claim:

1. A toner cartridge for an imaging apparatus comprising
  - a toner hopper and a rotatable developer roller which receives toner in controlled amounts from said toner hopper mounted together as a first unitary assembly,
  - a rotatable photosensitive roller having a central shaft, a cleaner chamber for cleaning untransferred toner from said photosensitive roller, and a cover member extending around and above said hopper mounted together as a second unitary assembly,
  - a resilient member connected between said first unitary assembly and said second unitary assembly, to pull said developer roller and said photosensitive roller into contact,
  - locating surfaces on opposite sides of said cartridge, said locating surfaces each comprising,
    - said central shaft of said photosensitive roller extending so that said central shaft is unobstructed for serving as a vertical and front to rear locator,
    - an elongated surface in the center of said cartridge having an upper surface unobstructed for receiving downward pressing members from said imaging apparatus, and
    - a flat ledge on a side of said hopper unobstructed for resting on a roller member in said imaging apparatus.
2. The toner cartridge as in claim 1 in which said locating surfaces also comprise a flat bottom surface of said cover proximate to said hopper for resting on the frame of said imaging apparatus.
3. The toner cartridge as in claim 2 in which said hopper contains electrophotographic toner for developing electrostatic images.
4. The toner cartridge as in claim 1 in which said hopper contains electrophotographic toner for developing electrostatic images.

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**T. LAWRENCE**  
**Certifying Officer**



US005768661A

**United States Patent** [19][11] **Patent Number:** **5,768,661****Coffey et al.**[45] **Date of Patent:** **Jun. 16, 1998**[54] **TONER CARTRIDGE WITH EXTERNAL PLANAR INSTALLATION GUIDES**

[75] Inventors: **Johnnie A. Coffey**, Winchester; **Larry Steven Foster**, Lexington; **Paul Douglas Horrall**, Lexington; **John Randolph McIntyre**, Lexington; **Richard Alden Ramsdell**, Lexington; **David Erwin Rennick**, Georgetown, all of Ky.

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[51] Int. Cl.<sup>6</sup> ..... **G03G 21/18**

[52] U.S. Cl. .... **399/111**

[58] Field of Search ..... **399/110, 111, 399/125, 119**

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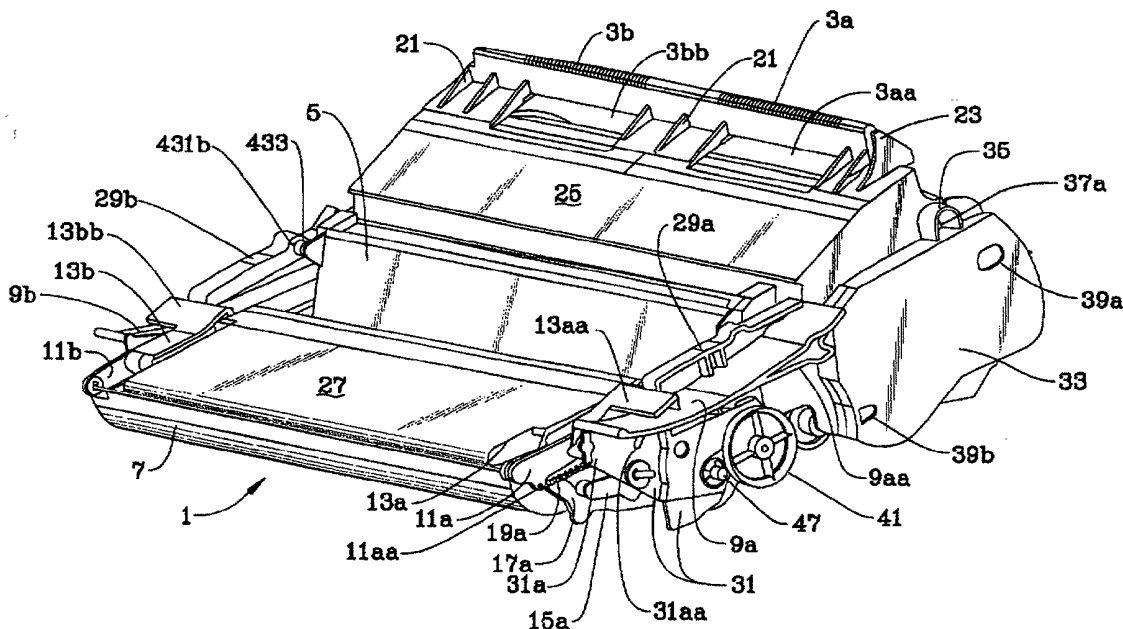
*Attorney, Agent, or Firm*—John A. Brady

[57] **ABSTRACT**

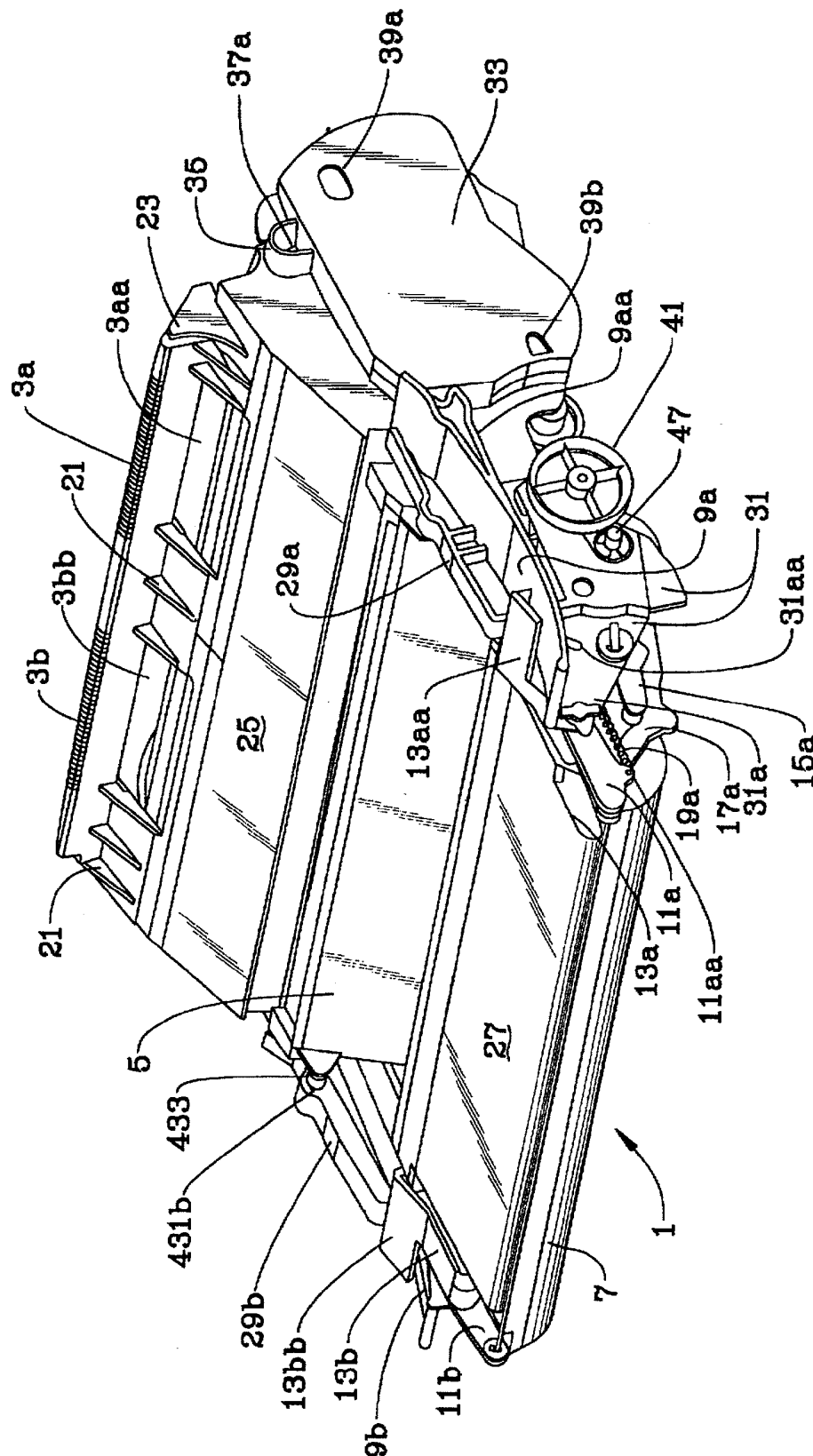
A toner cartridge (1) has wing-like guides (9a, 9b) on opposite sides, the guides being curved to follow a curved guide track in a printer in which the cartridge is installed. The cartridge may be readily grasped by handles (3a, 3b) and inserted in the guide tracks of the printer near the top and front and then readily directed down and into the rear area of the printer.

The guides are thin at their initial location of entry into the printer for easy insertion and increase to larger thickness regions (9aa, 9bb) to better guide the cartridge. The guides are a part of a unitarily molded cover assembly which includes the side walls (33, 241, 245).

**6 Claims, 23 Drawing Sheets**



**FIG. 1**



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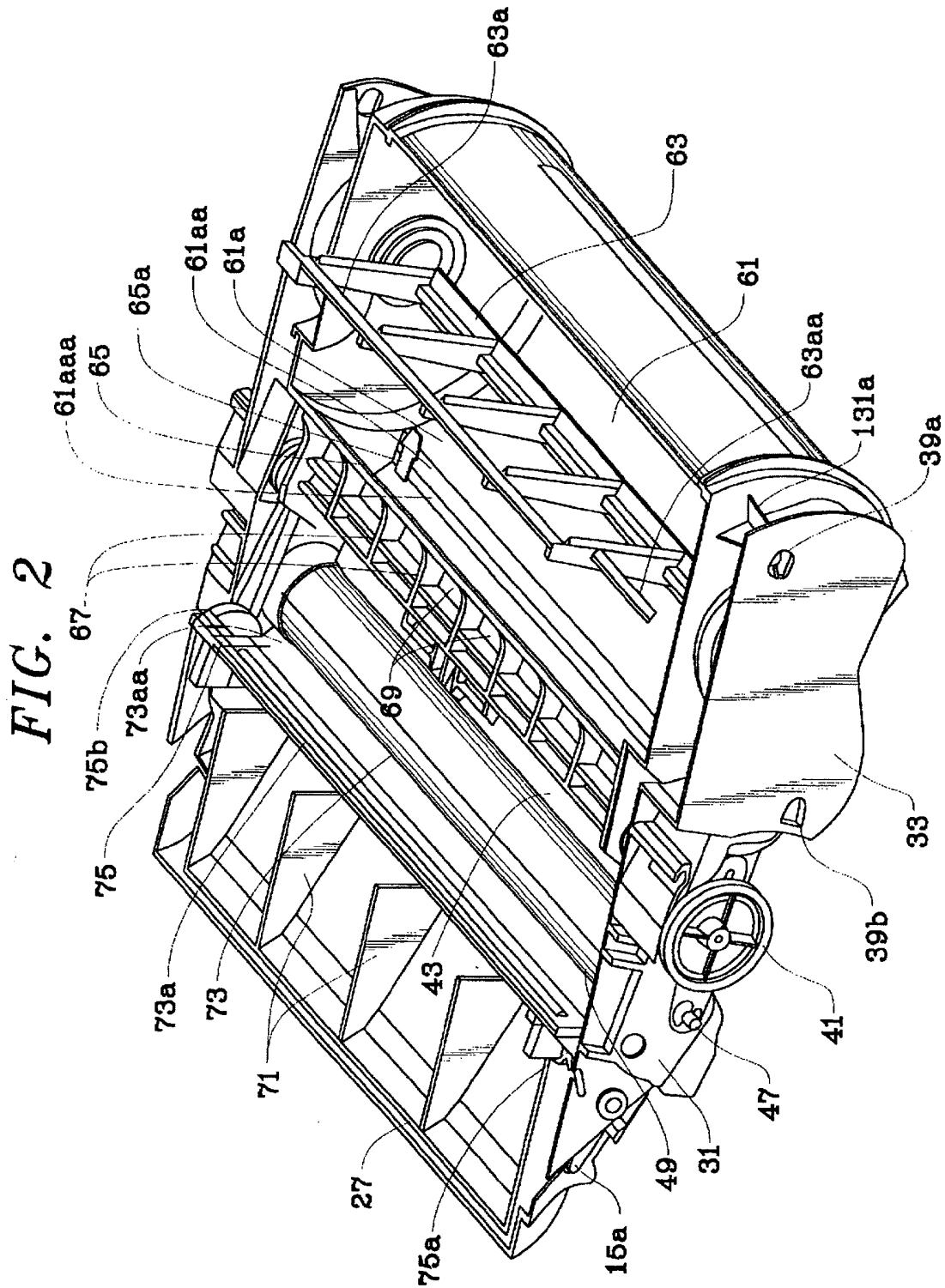
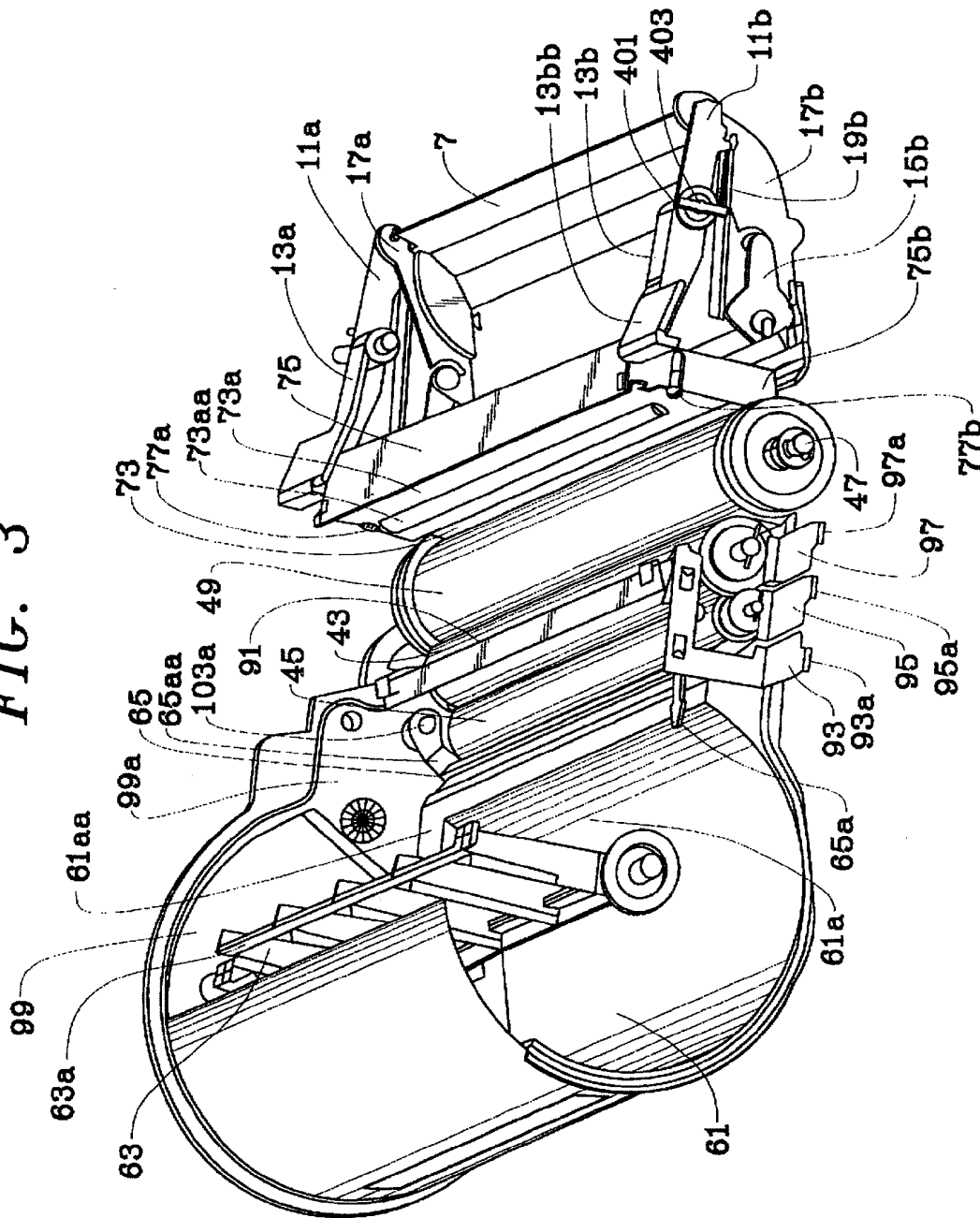


FIG. 3



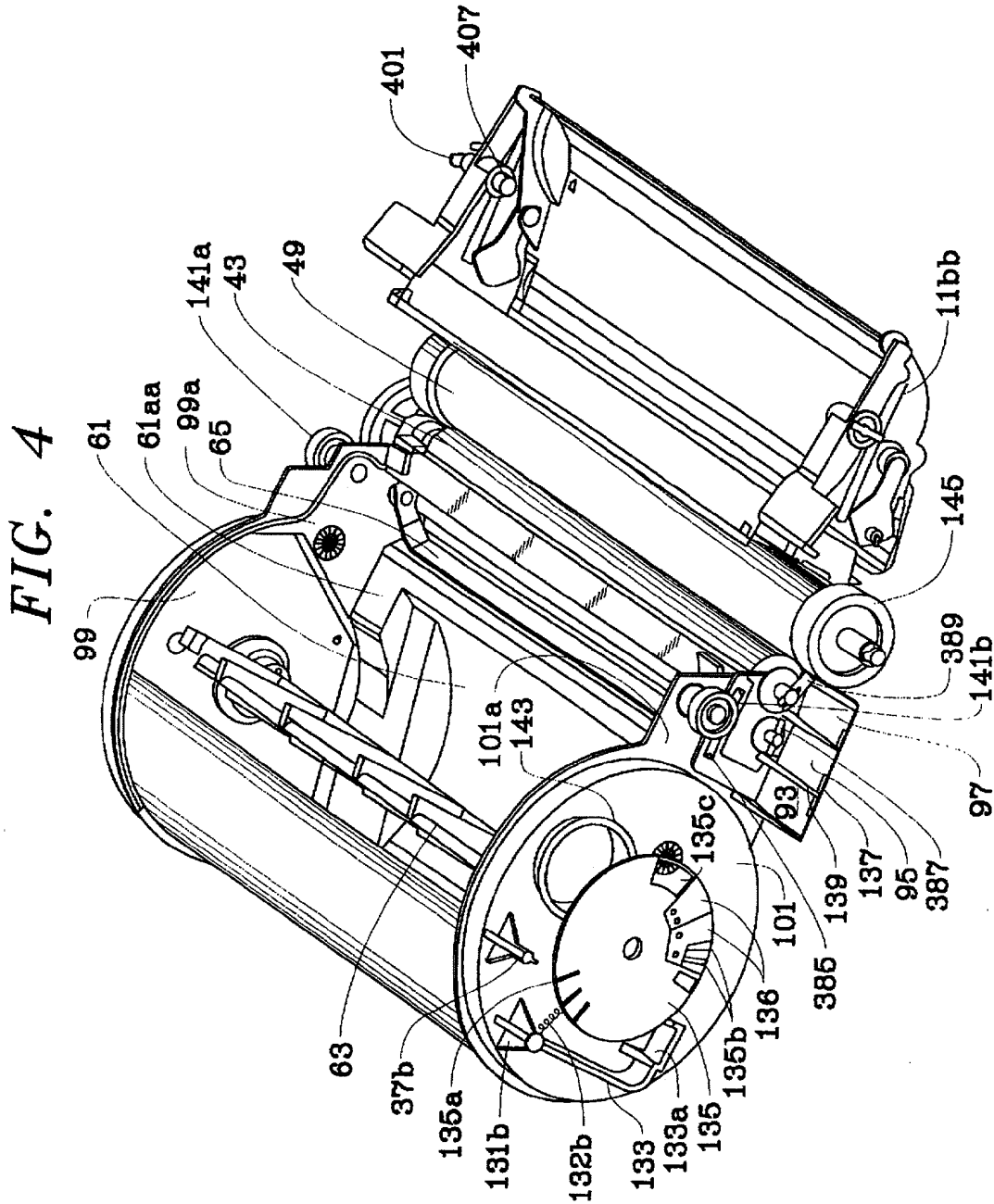


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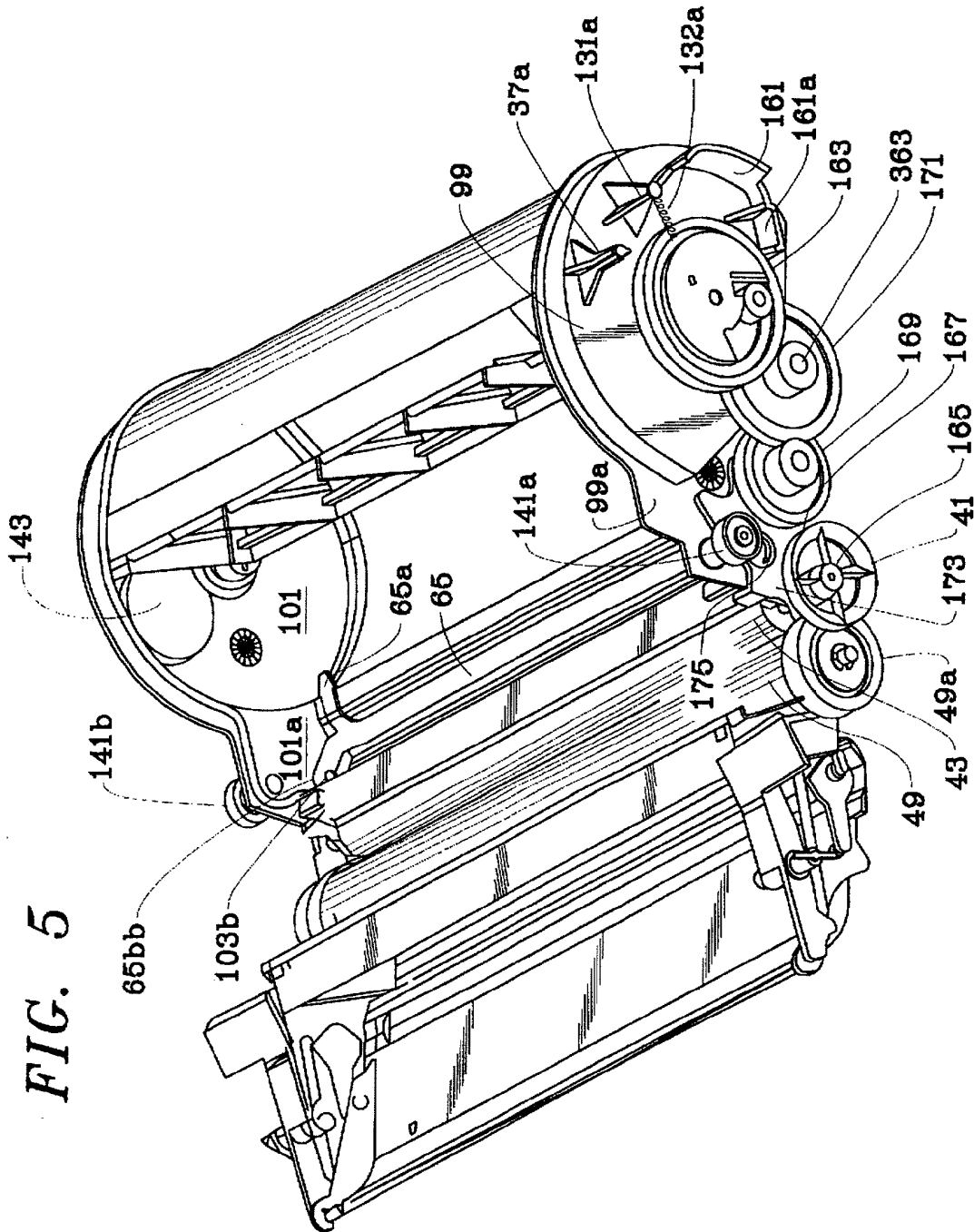


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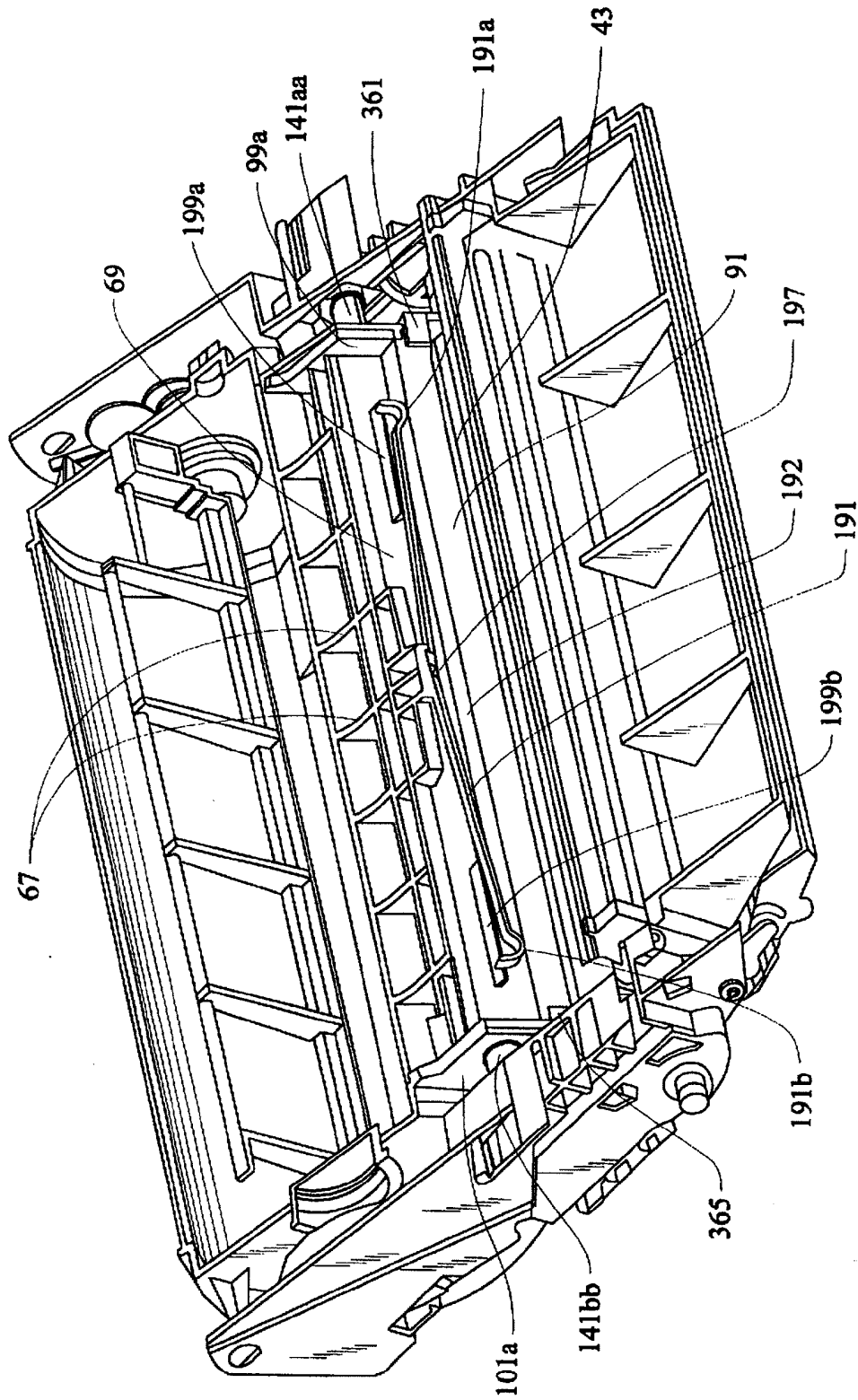
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FIG. 6



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FIG. 7

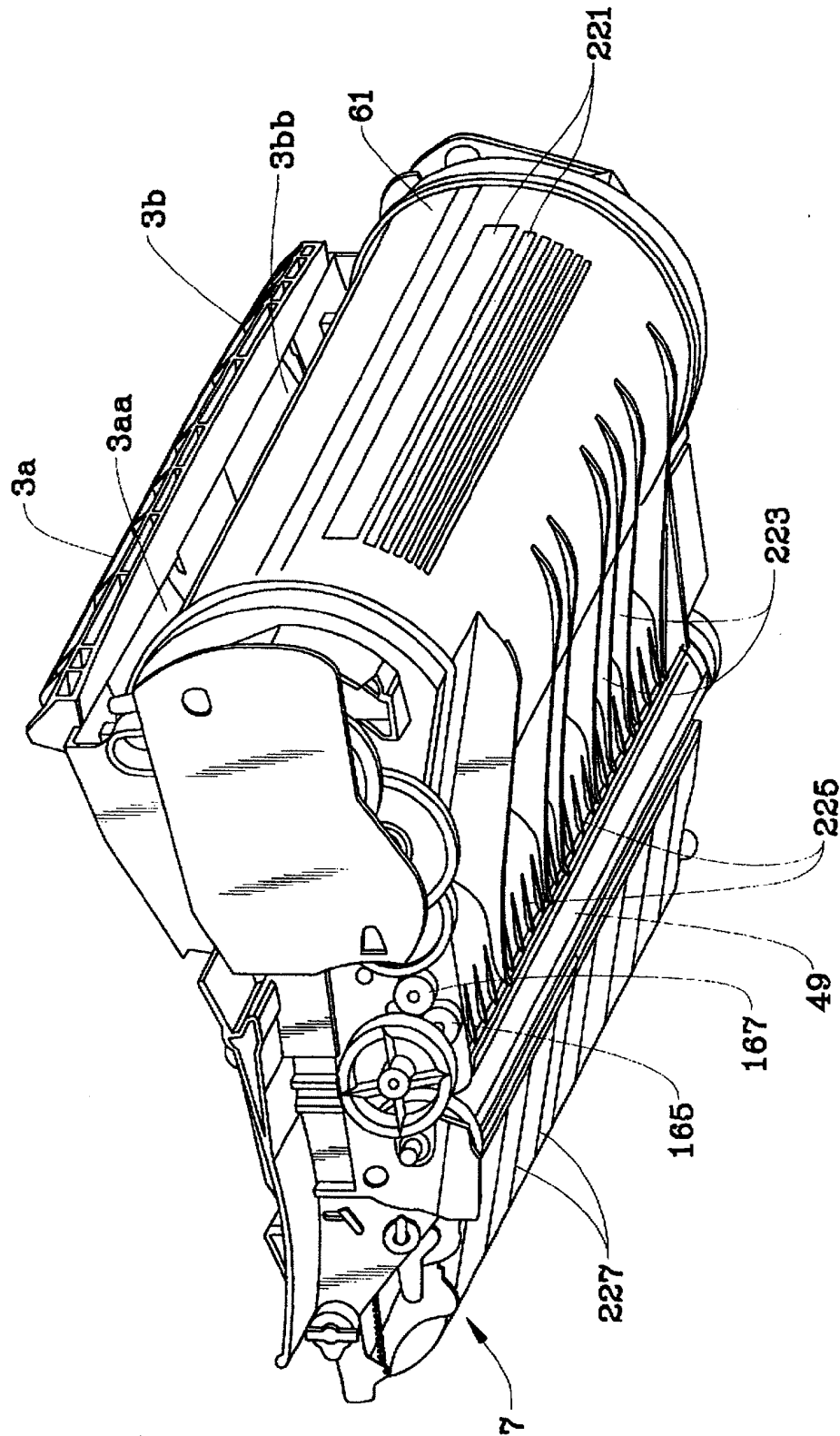
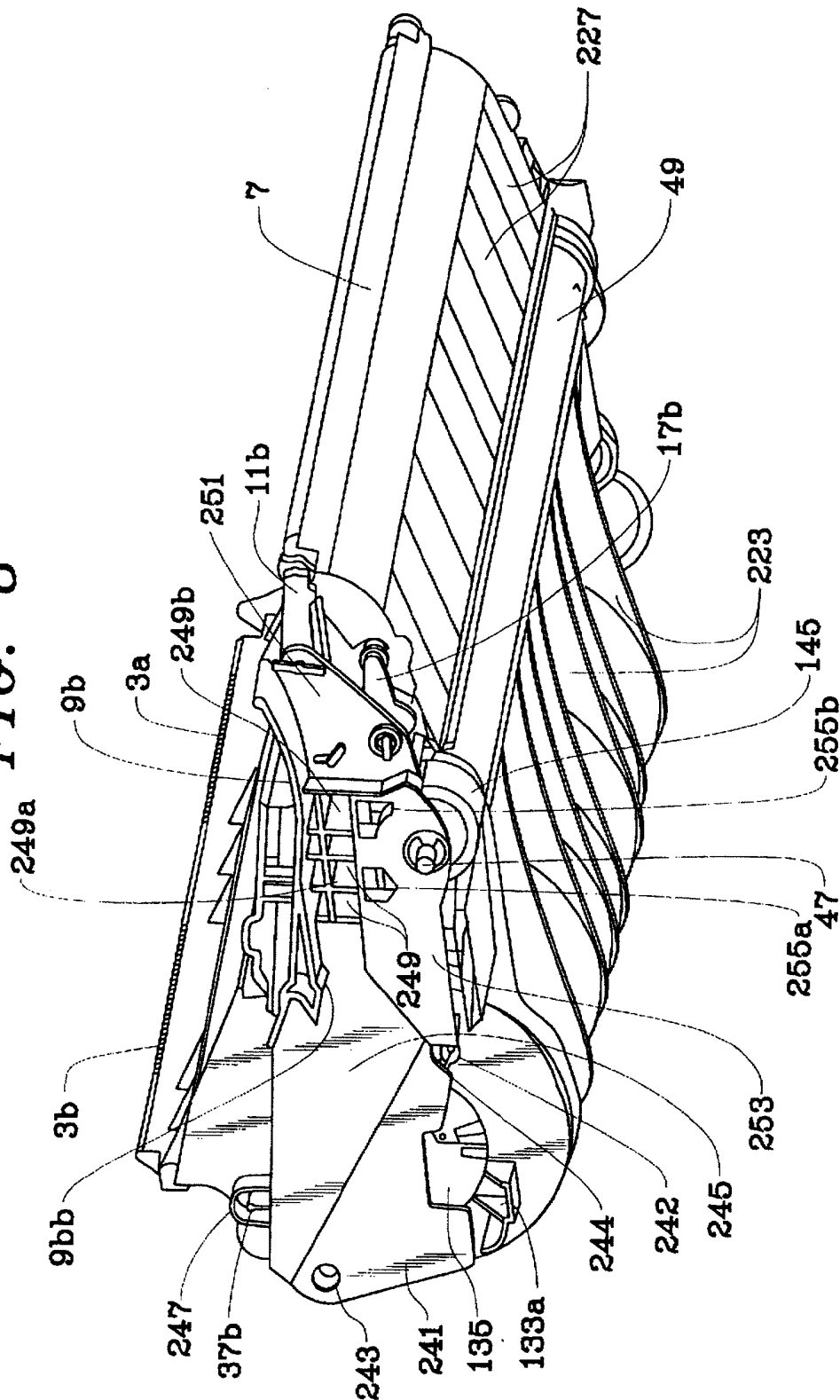


FIG. 8



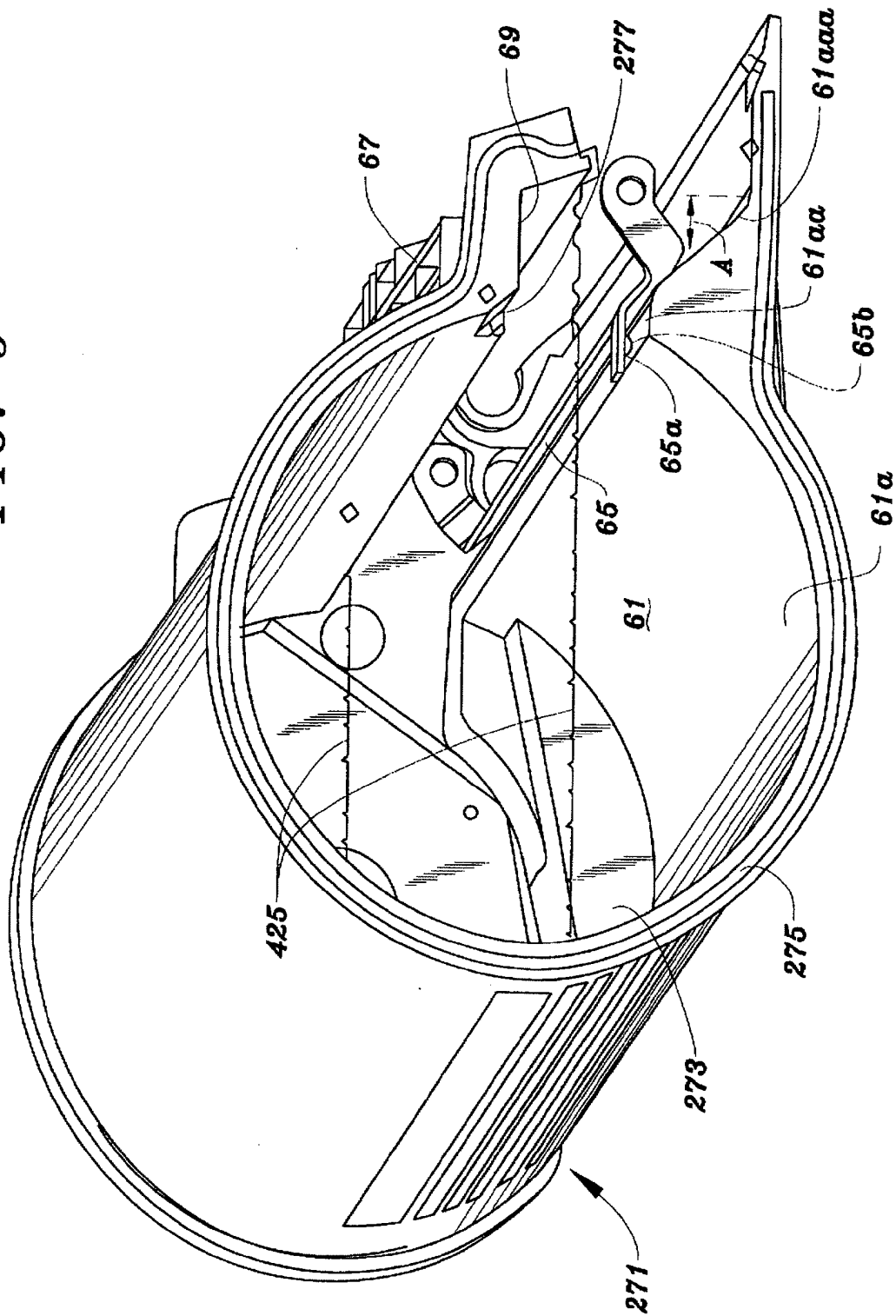
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FIG. 9



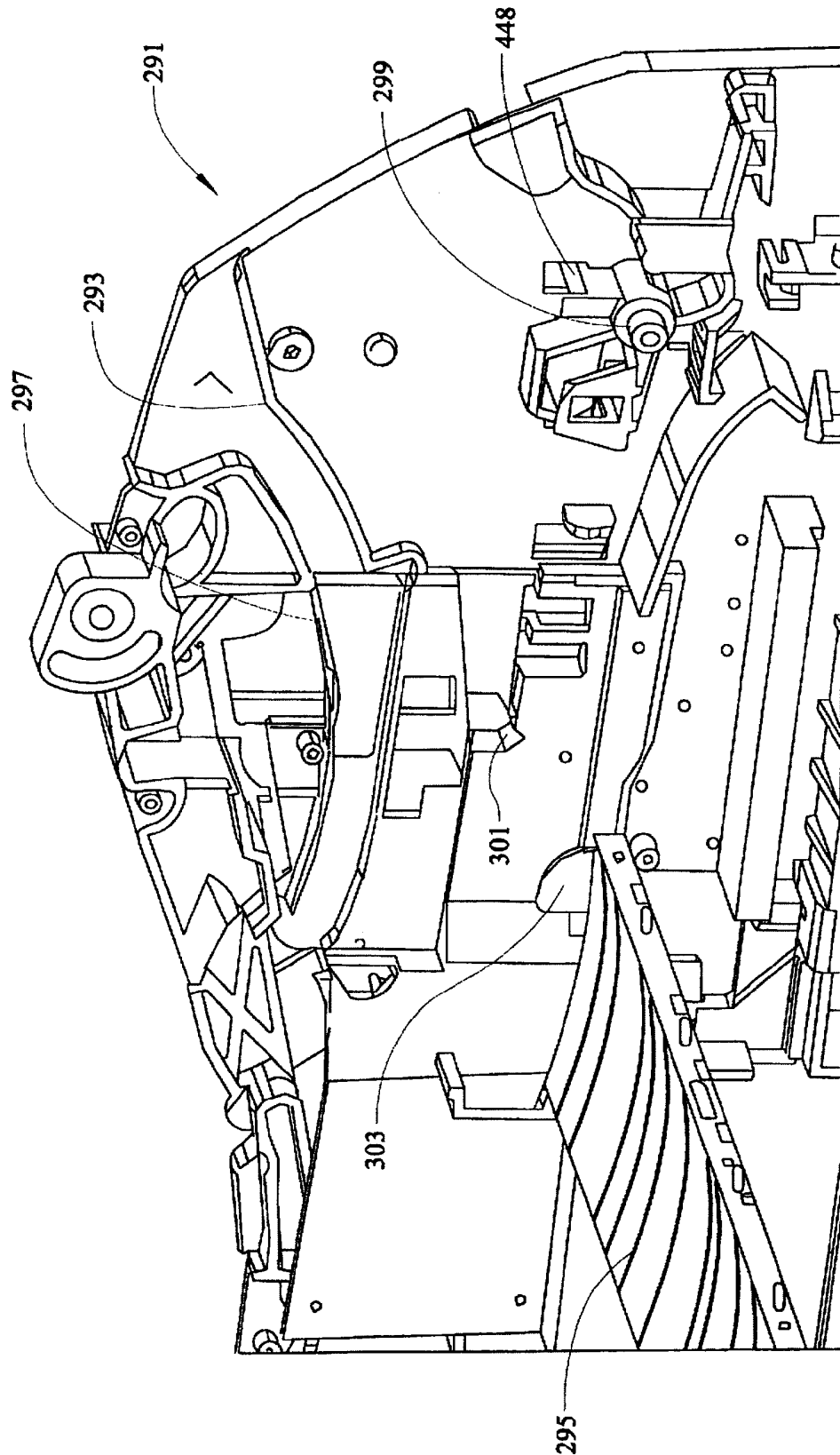
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FIG. 10





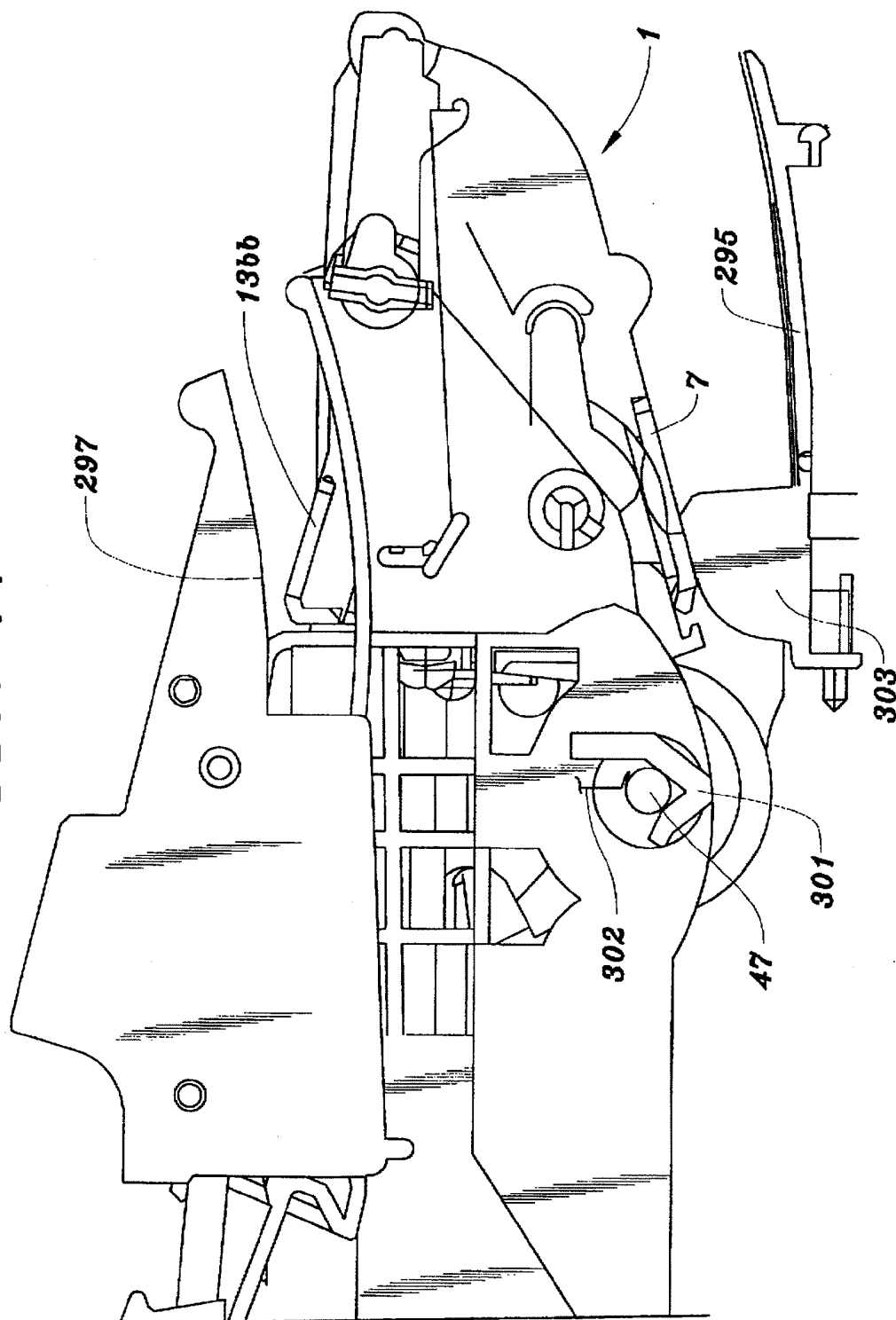
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FIG. 11

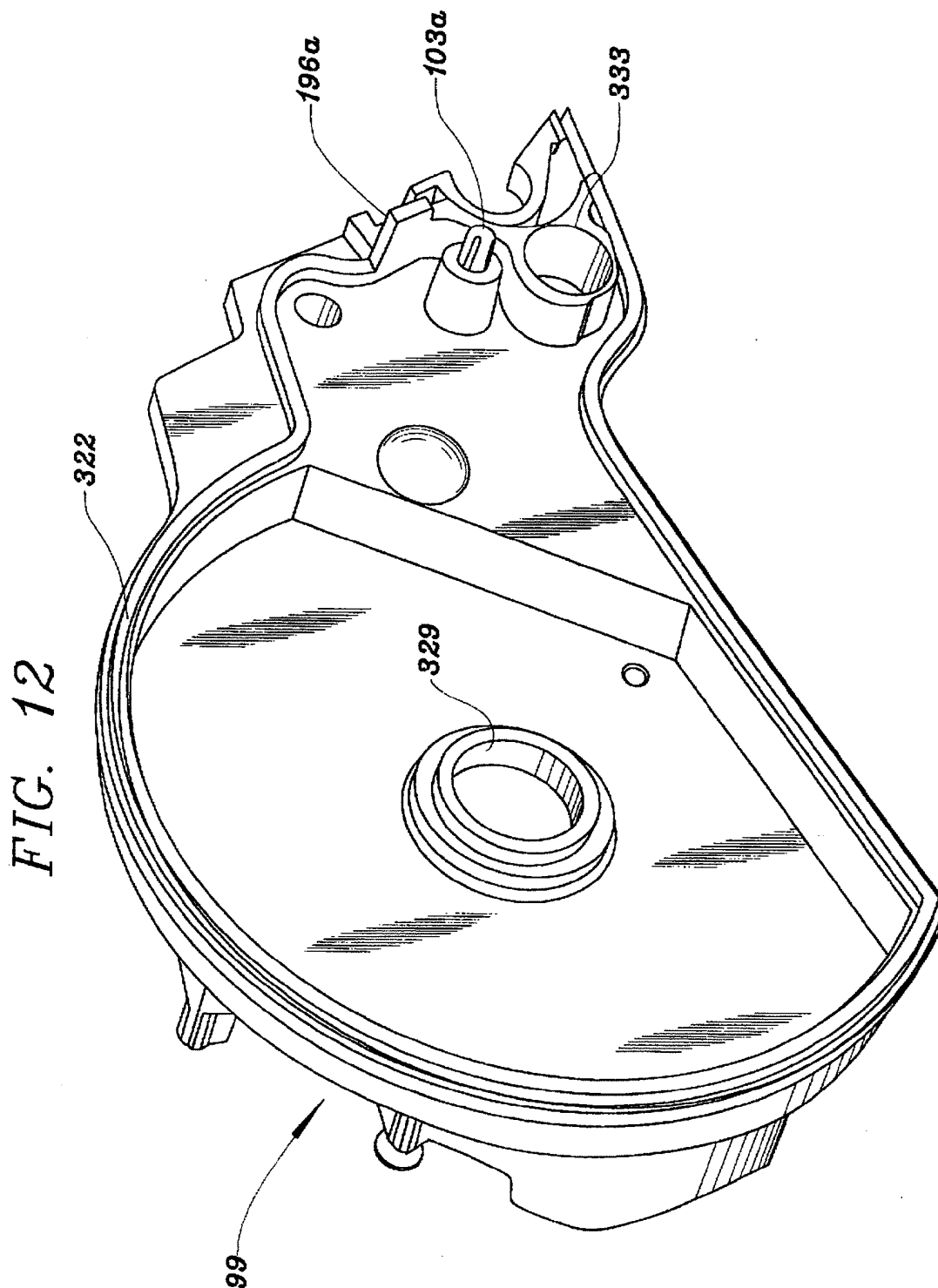


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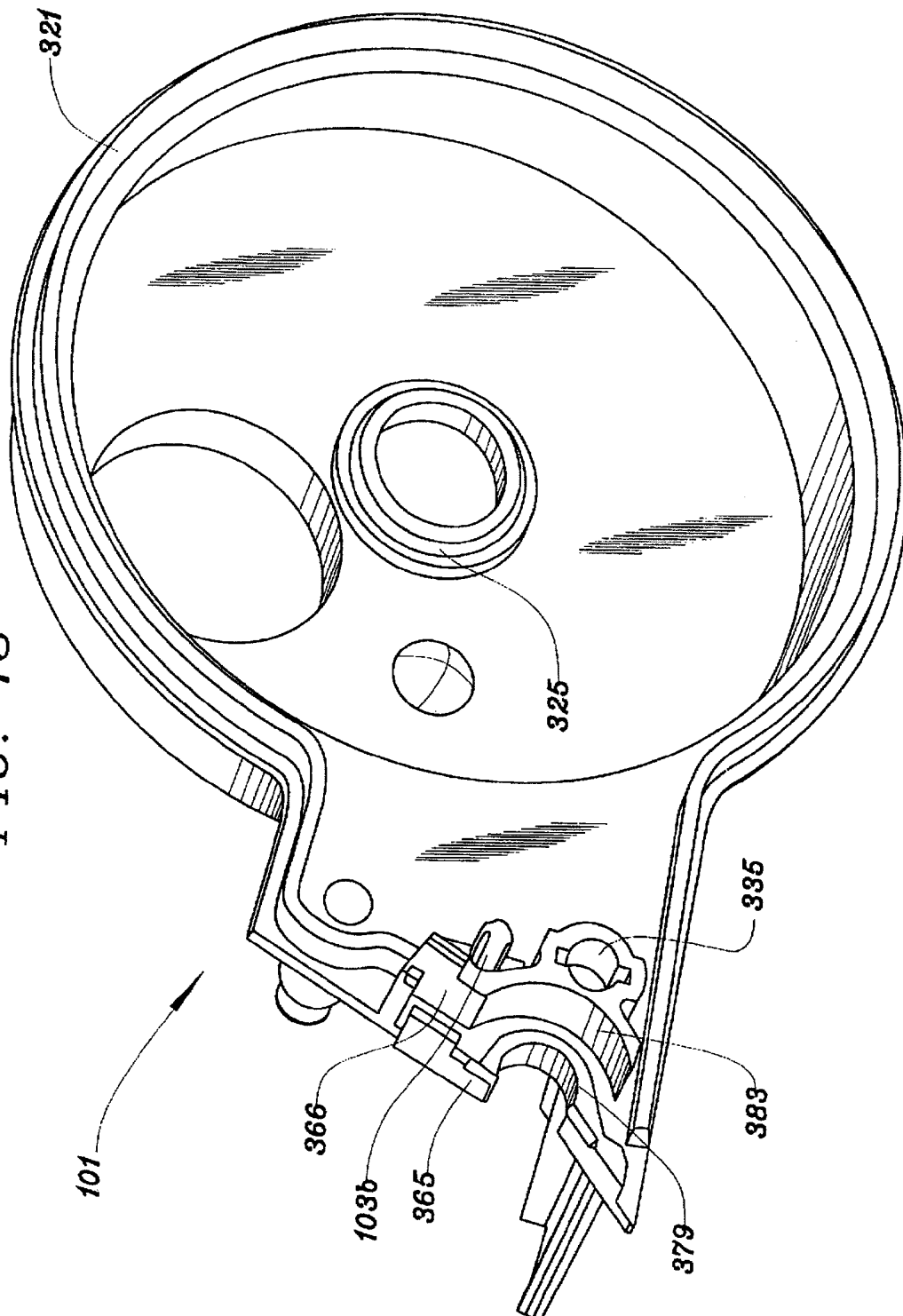
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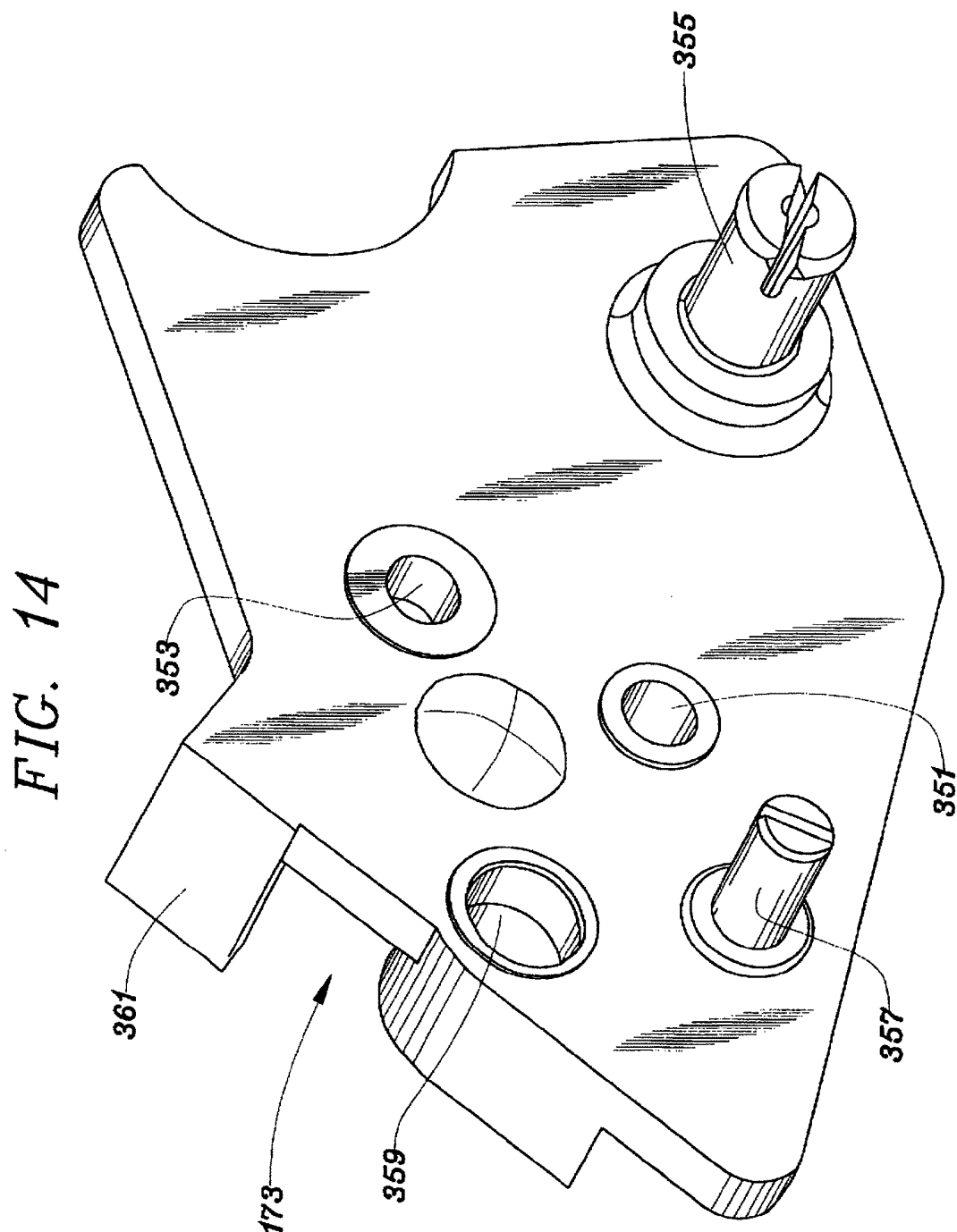
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FIG. 13





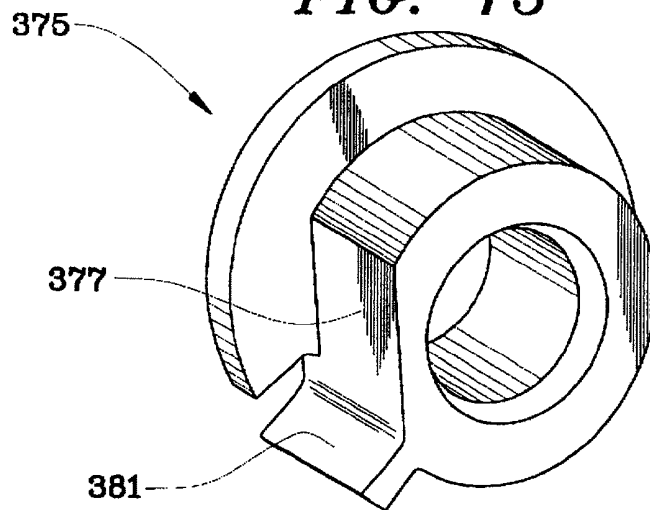
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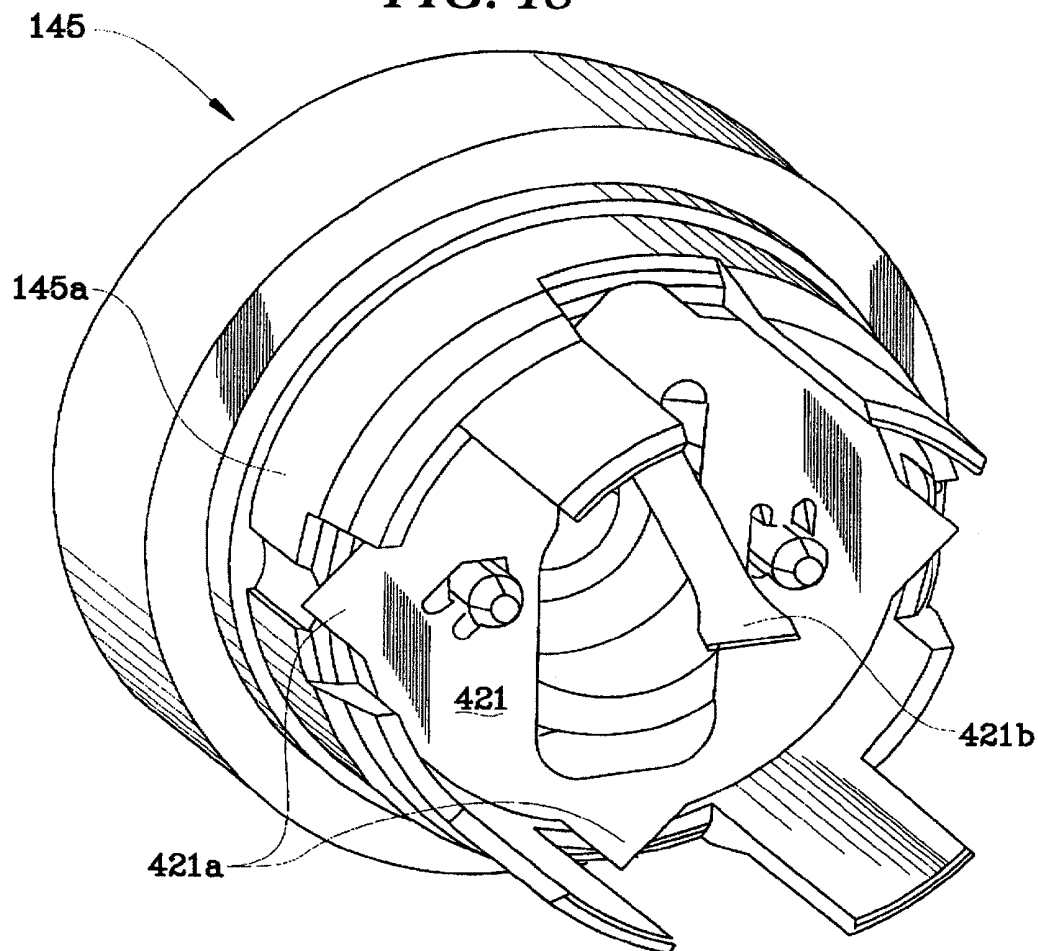
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*FIG. 15*



*FIG. 18*



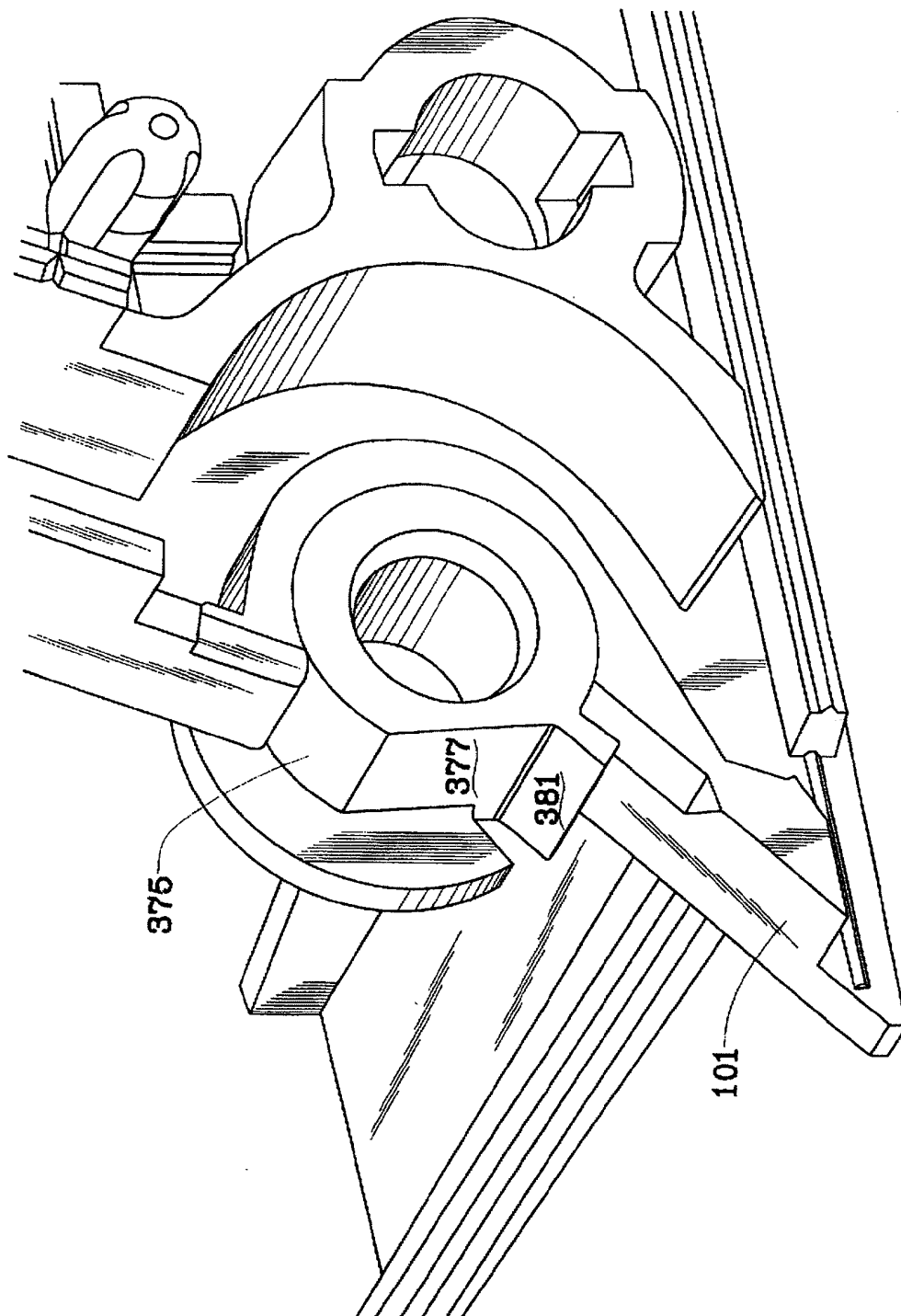
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**FIG. 16**





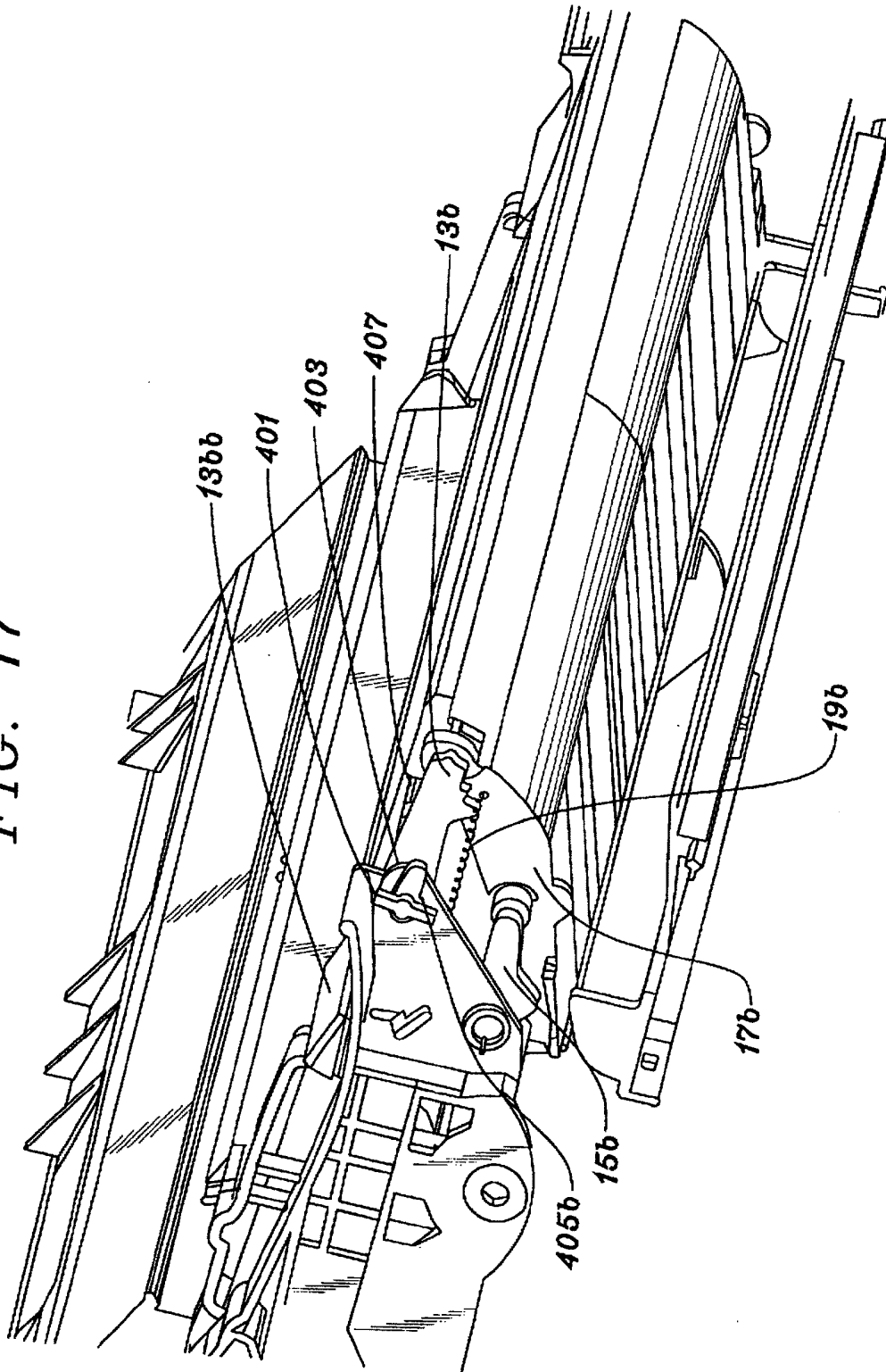
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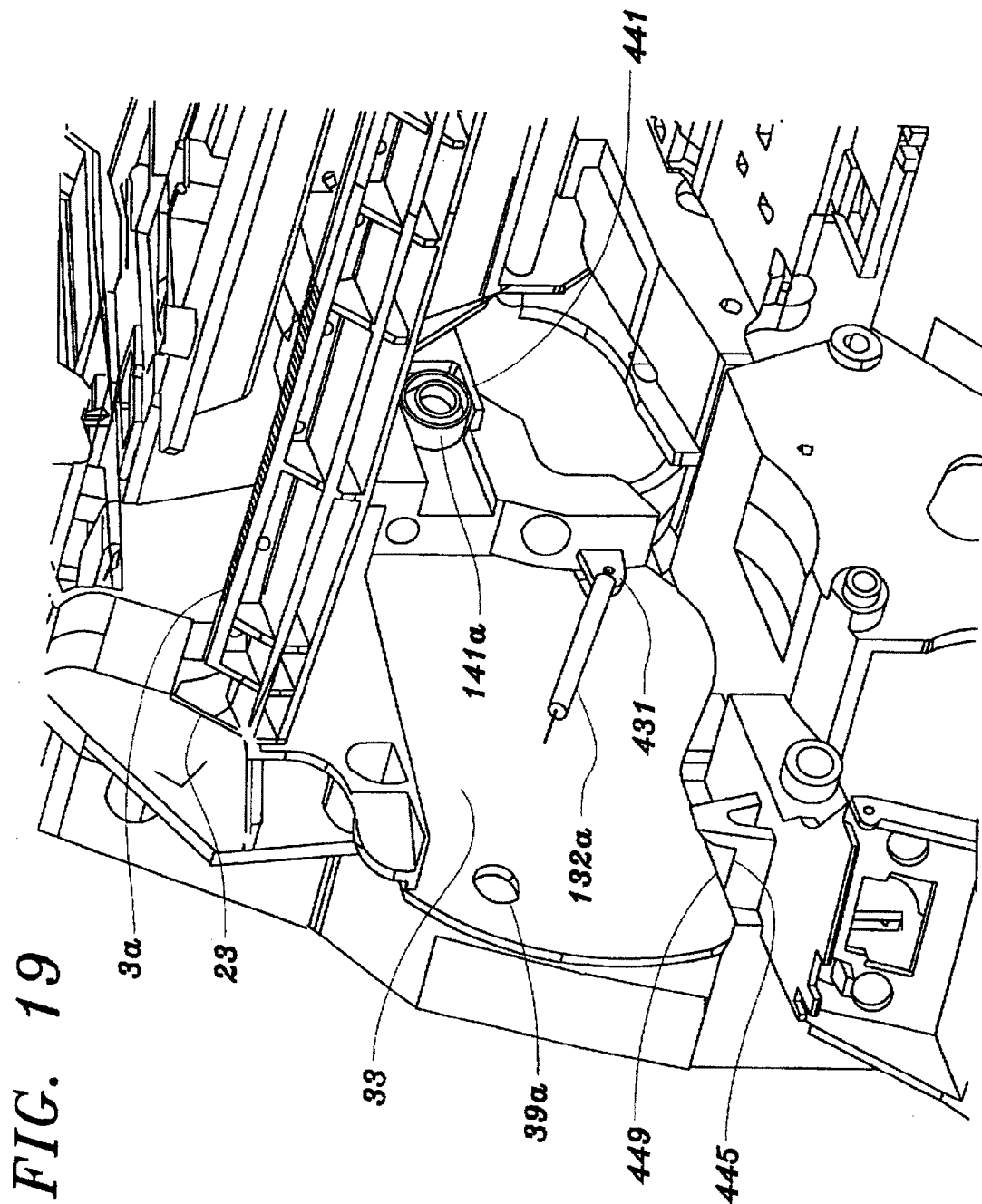
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FIG. 17





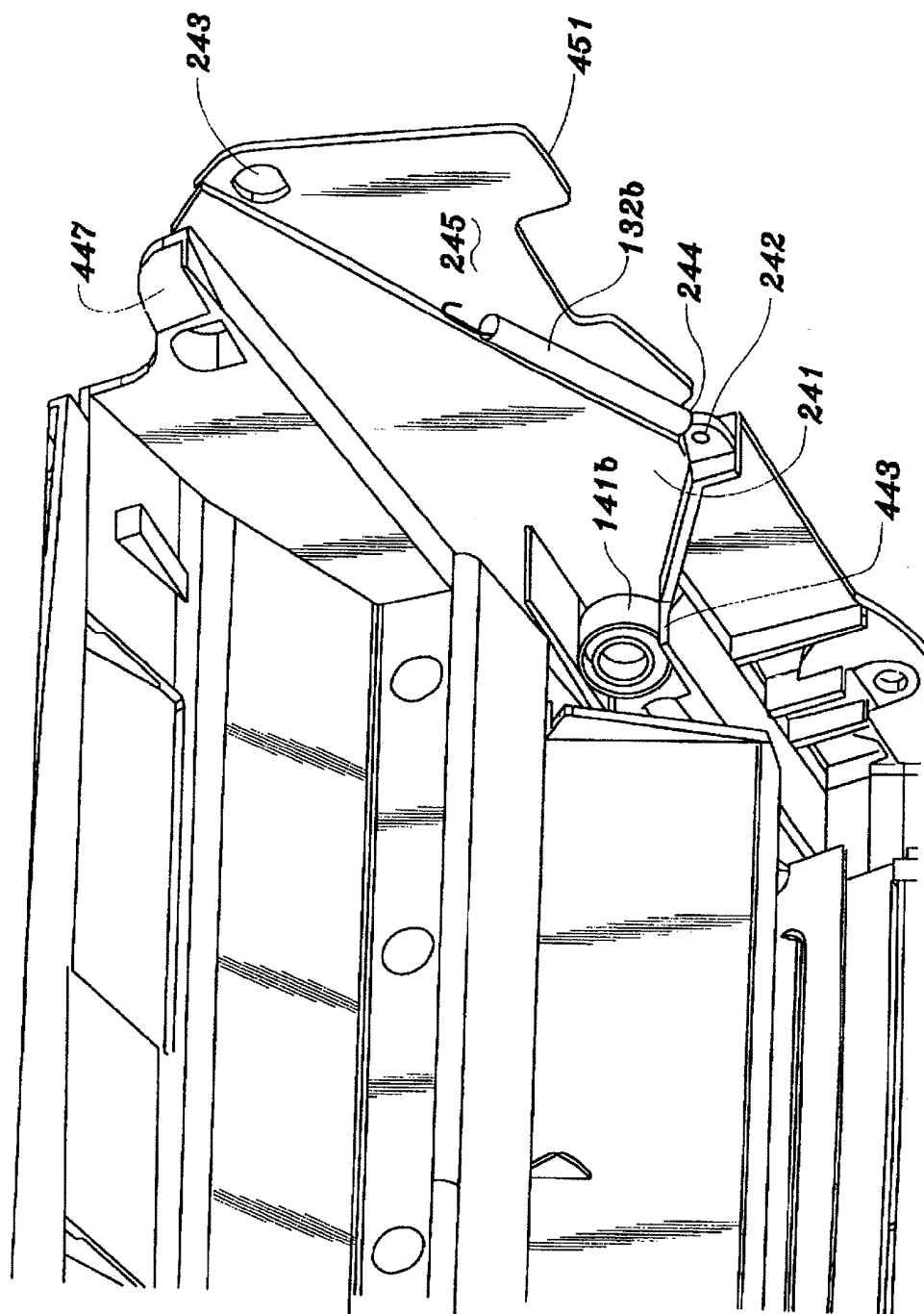
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FIG. 20



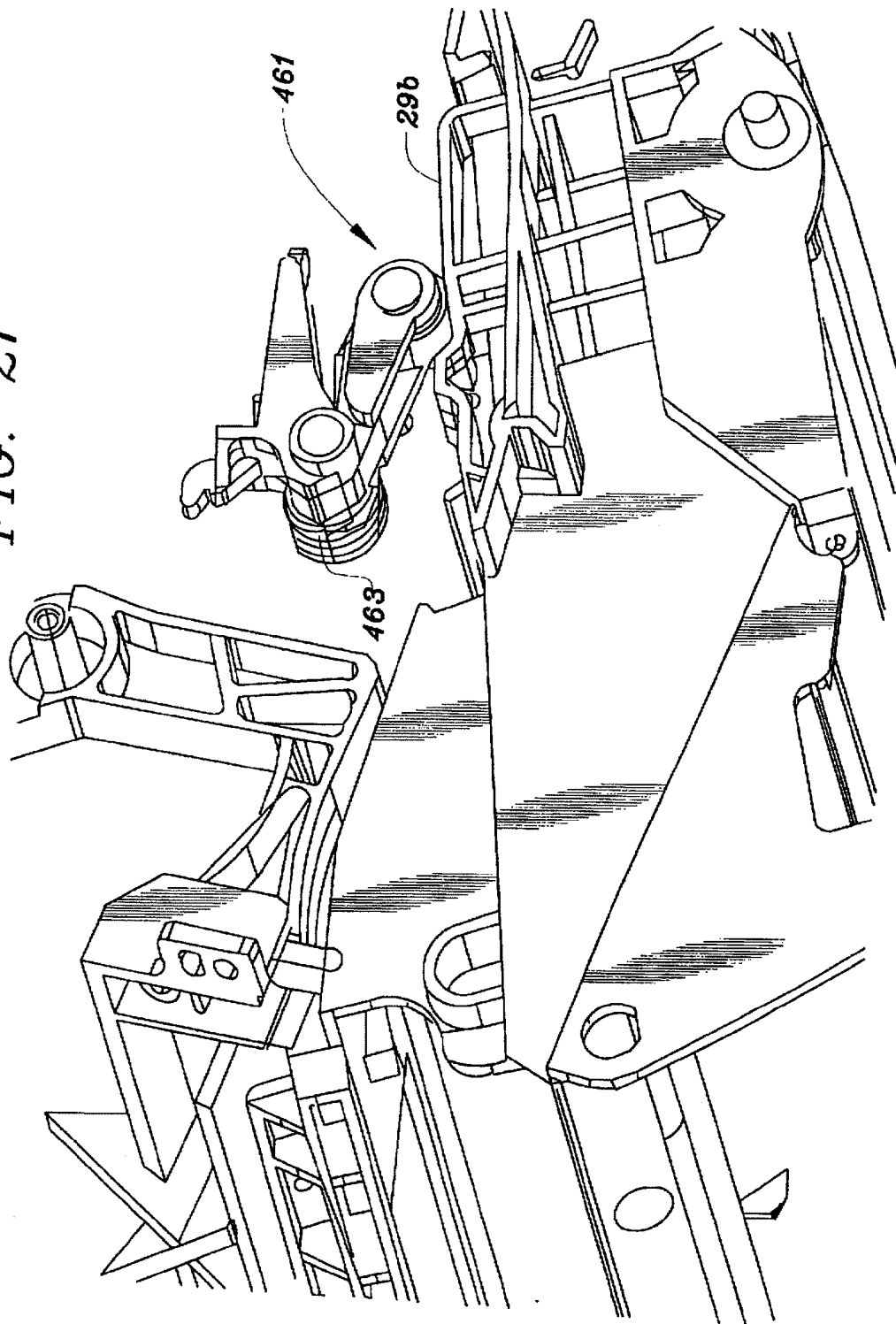
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*FIG. 21*



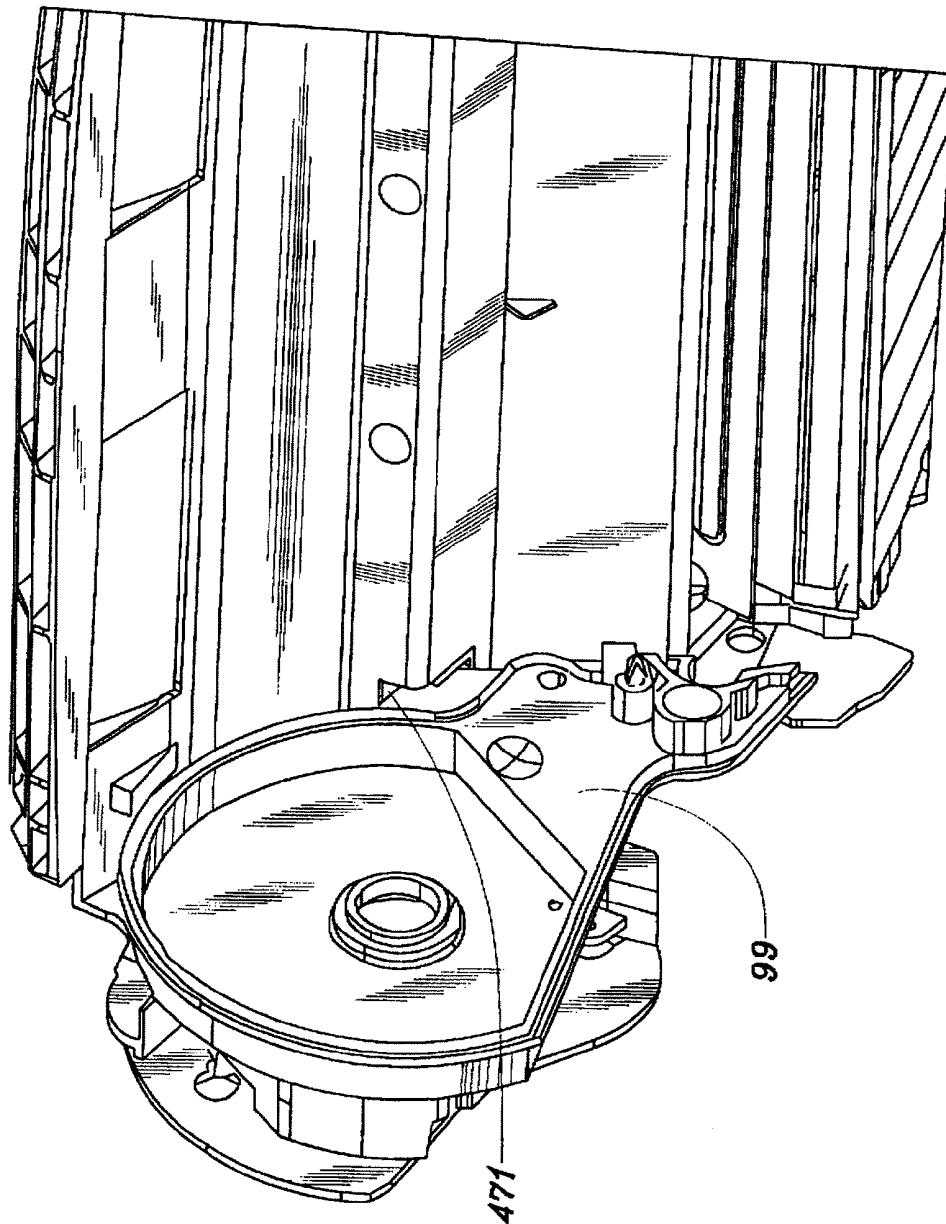
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FIG. 22









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## TONER CARTRIDGE WITH EXTERNAL PLANAR INSTALLATION GUIDES

### CROSS-REFERENCE TO RELATED APPLICATIONS

The following U.S. patent applications are directed to subject matter disclosed or incorporated in the disclosure of this application Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169, entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device; five utility applications filed the same day as this application entitled "Toner Cartridge with Hopper Exit Agitator," Ser. No. 08/770,328; "Toner Cartridge with Locating on Photoconductor Shaft," Ser. No. 08/770,326; "Toner Cartridge with Housing and Pin Construction," Ser. No. 08/770,330; "Toner Cartridge with Heat Shield Shutter," Ser. No. 08/770,334; and "Venting Plug in Toner Cartridge," Ser. No. 08/770,329, and one ornamental design application filed the same day as this application entitled "Toner Cartridge for Laser Printer." Ser. No. 29/066,775.

### TECHNICAL FIELD

This invention relates to electrophotographic development and, more particularly, relates to a toner cartridge having external installation guides.

### BACKGROUND OF THE INVENTION

The assignee of this invention has manufactured and sold commercially toner cartridges of two different general designs. For its larger laser printers the cartridge has contained a pump to meter toner of the kind disclosed in U.S. Pat. No. 5,012,289 to Aldrich et al. and U.S. Pat. No. 5,101,237 to Molloy, while the external structure of the cartridge is as disclosed in U.S. Pat. No. 5,136,333 to Craft et al. Details of other elements in the cartridge have varied.

For a smaller, light emitting diode printer, the cartridge is as disclosed in U.S. Pat. No. 5,337,032 to Baker et al., which has a toner hopper extending well below a level having the toner adder roller and which has independent driven systems for the photoconductor roller and for the developer roller system as disclosed in U.S. Pat. No. 5,331,378 to Baker et al.

U.S. Pat. No. 5,528,342 to Setoriyama discloses a cartridge, generally of the aforementioned kind, with insertion guides, the guides being spaced projections. The present invention employs planar insertion guides on opposite sides of the cartridge. This permits ready installation of the cartridge from the front to well within a printer by a person directing the guides into slots in the printer.

### DISCLOSURE OF THE INVENTION

The present invention comprises a toner cartridge having external guides on opposite sides, which are planar, suggestive of wings, and which are curved to follow a curved guide track in a printer. The cartridge may be grasped by a person and readily inserted in the guide tracks of the printer near the top and front of the printer, allowing the cartridge to be readily directed down into a rear area in the printer.

The planar members are thin at their initial location of entry into the guide slot for ease in insertion and increase to larger thickness at their rear locations to more closely guide the cartridge. The outer cover of the cartridge is largely a single molded piece which includes the planar guide.

### BRIEF DESCRIPTION OF THE DRAWING

The details of this invention will be described in connection with the accompanying drawing, in which

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FIG. 1 is a perspective view of the toner cartridge from above and left rear, where left is determined facing the printer from its front side where cartridge insertion is made;

FIG. 2 is a perspective view from above and left front of the cartridge sectioned near the top;

FIG. 3 is a top right front view of the cartridge with further cover elements removed;

FIG. 4 is a top right rear view of the cartridge with cover elements removed;

FIG. 5 is a top left rear view of the cartridge with cover elements removed;

FIG. 6 is a top right rear view of the cartridge sectioned similarly to the sectioning of FIG. 2;

FIG. 7 is a bottom left front view of the cartridge;

FIG. 8 is a bottom right rear view of the cartridge;

FIG. 9 is a front right perspective view of the hopper housing member;

FIG. 10 is a left front view of the inside of a printer in which cartridge 1 is installed;

FIG. 11 is a partially sectioned right side view showing more detail of parts shown in FIG. 10 with the cartridge installed;

FIG. 12 is a perspective view showing the inside one end member of the hopper;

FIG. 13 is a perspective view showing the inside of the other end member of the hopper;

FIG. 14 is a perspective view of the gear plate;

FIG. 15 is a perspective view of a readily removable bushing;

FIG. 16 is a perspective view showing the removable bushing installed;

FIG. 17 is a right rear view showing detail of a shutter;

FIG. 18 is a perspective view of an extended hub inserted in the photoconductor drum;

FIG. 19 is a right perspective view showing elements inside the cover of the cartridge;

FIG. 20 is a left bottom perspective view showing elements inside the cover of the cartridge;

FIG. 21 is a right perspective view showing parts of the cartridge installed in a printer; and

FIG. 22 shows the inside of the cover of the cartridge where it receives an extension from the hopper;

FIG. 23 shows elements of the hopper plug prior to assembly;

FIG. 24 shows the assembled hopper plug alone; and

FIG. 25 shows a staggered cross section of the hopper plug to illustrate air flow.

### BEST MODE FOR CARRYING OUT THE INVENTION

The self-contained, removable printer cartridge 1 is shown in FIG. 1 in a perspective view from above and left rear (the hand grips 3a and 3b being considered the front and the side having the pivoted upper shutter 5 being the upper side).

For purposes of illustration, FIG. 1 shows the upper shutter 5 pivoted downward to its open position and lower shutter 7 pivoted rearward and upward to its open position. In actual operation, these positions are reached by interaction with the printer or other device in which cartridge 1 is installed as will be explained below.

To facilitate and guide insertion of cartridge 1 into the printer, cartridge 1 has a left guide wing 9a and a right guide

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wing 9b. Guide wings 9a and 9b are thin planes formed as arcs of a relatively large circle, except near the front, where the bottom 9aa is enlarged downward. Guide wings 9a and 9b are mirror images of each other except that, in this particular embodiment described, the left guide wing 9a is wider (extends further laterally) than the right guide wing 9b simply to accommodate the width provided by a particular printer in which the exemplar cartridge 1 is to be installed.

In the embodiment herein described, bottom shutter 7 is pivoted from left-rear cover 31a on a left top actuator link arm 11a and from rear cover (not shown) on a right top actuator link arm 11b, located on opposite sides of shutter 7. Each link arm 11a, and 11b is integral with an actuator 13a, and 13b, respectively, each of which has a rectangular actuator surface 13aa and 13bb, respectively, which extends over the respective guide wings 9a, 9b.

A pivoted lower shutter link 15a and a side of the lower shutter 17a, pivoted to lower link 15a and upper actuator link 11a complete a conventional four bar linkage to provide rotation of shutter 7 in response to rotation of actuator 13a. The rear end of coil spring 19a connects to a lower hook 11aa in link arm 11a to bias shutter 7 closed when the cartridge is not inserted in a printer or other device. The front end of coil spring 19a connects to an upper hole 31aa under actuator 13a. A mirror image of these parts (see FIG. 3) exists on the opposite side, the corresponding part of which will be designated by the same number with "b" letters.

When cartridge 1 is installed in the printer, actuator surfaces 13aa and 13bb are pushed downward by the mating surfaces of the printer to the positions above wings 9a, 9b respectively, as shown in FIG. 1.

Cartridge 1 is inserted by a human operator grasping grips 3a, 3b through holes 3aa, 3bb and moving cartridge 1 in the direction of shutter 5 and toward the rear of the printer (291, FIG. 10) in which it is being installed. A series of upwardly extending ribs 21 spaced along the width of cartridge 1 under grips 3a, 3b, except at holes 3aa and 3bb, provide strength while holes 3aa and 3bb provide room for the fingers of a person to grasp grips 3a, 3b. On the left side is a relatively wide, upwardly extending tab 23. In a preferred combination of the embodiment of the invention described herein and an exemplary printer the top of tab 23 interacts with a physical sensing switch in the printer to detect that a cartridge 1 has been installed.

Front cover 25, on which grips 3a, 3b, ribs 21 and tab 23 are integrally formed, is above a separated toner hopper, as will be described. The top cover of cleaner chamber 27 is rearward of shutter 5.

Immediately inside wings 9a and 9b are raised, elongated locator surfaces 29a, 29b to which pressure is applied by a printer to firmly position the toning mechanisms of cartridge 1 when cartridge 1 is installed. Locator surfaces 29a and 29b, wings 9a and 9b, as well as rear cover 31 under wing 9a, are formed integral with cleaner housing 27. Also integral with these elements is front cover 25, having grips 3a, 3b and an outer cover 33 on the left side and generally coextensive in length with the length of front cover 25. Cover 33 has a U-shaped housing 35 at its top. Housing 35 traps spacer stud 37a as will be explained and an assembly hole 39a near the upper front of cover 33 and a spring-holding hole 39b near the lower front of cover 33.

A coupler 41 receives a drive element from a printer which contains an Oldham coupler to rotatably drive the developer roller 43 (not shown in FIG. 1) and toner adder roller 45 (not shown in FIG. 1). To the rear of coupler 41 is the shaft 47 of photoconductor drum 49 (drum not shown in FIG. 1).

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FIG. 2 is a perspective view from above and left front of cartridge 1 sectioned near the top to show internal elements. At the immediate front is a large, cylindrical toner hopper 61, having a paddle 63, which, during operation, is rotated clockwise as seen in FIG. 2. Paddle 63 has an outer toner moving bar 63a, which extends across the width of hopper 61 except for a far left section 63aa which is inset as will be explained. The rear wall 61a of hopper 61 when cartridge 1 is installed for operation in a printer terminates at about one-third of the total height of hopper 61 as a flat surface 61aa (specifically, hopper 61 has a 106 mm diameter and the distance vertically from the lowest point of hopper 61 to the horizontal plane coinciding with the highest point surface 61aa of rear wall 61a is 35.3 mm). The upper surface 61aa of rear wall 61a is thin and flat with a slight downward angle from hopper 61 to facilitate removal of the molded part from its mold. An extension 65a from an agitator bar 65 has a depending tab 65b (see FIG. 9) which rests on upper wall 61aa thereby positioning bar 65 slightly above upper wall 61aa. Extension 65a extends past upper wall 61aa to a location at which bar 63a of paddle 63 encounters extension 65a as it rotates. The surface 61aaa opposite surface 61aa from which toner exits is flat and at approximately 50 degrees from vertical (best seen in FIG. 9) when cartridge 1 is installed for operation in a printer.

Vertical ribs 67 located immediately rearward of rear wall 61a are stiffeners for top wall 69 formed about one-third down from the top of hopper 61. The toner moving bar 63a of paddle 63 is closely adjacent to the sides of hopper 61 except where the top of rear wall 61a and the start of top wall 69 form an opening for toner to be delivered rearward from hopper 61 to the toning mechanisms of cartridge 1. This is best shown in FIG. 9.

In FIG. 2, a small part of developer roller 43 to which coupler 41 is directly attached, is seen past ribs 67. Developer roller 43 is parallel to and in contact with photoconductor drum 49. Cleaner chamber 27 has spaced, vertical internal baffles 71, which are strengthening members, as well as members which limit unbalanced accumulation of toner in chamber 27. Toner which is not transferred during development is scraped from photoconductor drum 49 by cleaning blade 73, which is mounted to a vertical panel 73a, having a horizontal gusset 73aa to increase strength. As best seen in FIG. 3, panel 73a is mounted to supporting member 75, which has vertical columns 75a (FIG. 2), 75b on opposite sides. Panel 73a is mounted to the vertical columns 75a, 75b by a screw 77a to panel 75a and a screw 77b to panel 75b.

FIG. 3 is a top right side view with further cover elements removed and part of the cleaner removed to illustrate the internal configuration of cartridge 1. A solid, steel-bar doctor blade 91 extends parallel with and in pressure contact with developer roller 43. Blade 91 contacts roller 43 at about 20 degrees from the vertical toward toner adder roller 45. Also shown in FIG. 3 are metal electrical contact 93 to doctor blade 91, metal electrical contact 95 to toner adder roller 45 and metal electrical contact 97 to developer roller 43. The outer ends 93a, 95a, 97a of the contacts bear against metal contacts in the printer when cartridge 1 is installed and thereby make electrical contact to receive electrical potentials from the printer.

The developing system of cartridge 1 is essentially very similar to that of the Optra brand family of printers sold by the assignee of this invention. As in that family of printers, toner adder roller 45 is a conductive sponge material attached to a steel shaft and developer roller 43 is semiconductive material attached to a steel shaft. When cartridge 1

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is installed for operation in a printer, cartridge 1 is oriented generally as shown in FIG. 3 and the horizontal plane containing the lowest surface of toner adder roller 45 is 22.6 mm above the lowest point of hopper 61.

Toner adder roller 45 and developer roller 43 are journaled in the rearward extensions 99a and 101a (FIG. 4) of the end members 99 and 101 (FIG. 4) of hopper 61. Agitator 65 has a bent portion 65aa to become parallel to extension 99a where it is pivoted to extension 99a on pin 103a. As paddle 63 rotates, bar 63a contacts extension 65a, thereby rotating agitator 65 around pin 103a upward. Agitator 65 then returns to near rear wall 61a under the force of gravity to dislodge toner, which otherwise tends to accumulate on exit surface 61aaa (see FIG. 9).

FIG. 4 is a top right rear view with cover elements removed showing more fully the end members 99 and 101 of hopper 61 and their extensions 99a and 101a. Integral with end member 101 is spacer stud 37b. Under and to the front of stud 37b is spring mounting post 131b, which mounts one end of spring 132b, the other end of which is mounted on hole 242 (best seen in FIG. 20).

Also integral with end member 101 is perpendicular shield wall 133, which extends downward and rearward to present a barrier to physically protect encoder wheel 135. The bottom portion of wall 133 forms a flat contact surface 133a to receive a locating roller from the printer when cartridge 1 is installed. Encoder wheel 135 is linked to paddle 63 through a paddle gear assembly 163 having a torsional yield member (FIG. 5) so as to provide information as to the amount of toner in hopper 61 to the printer on which cartridge 1 is installed by the sensing of the location of windows 135a. Additionally, other windows 135b provide other information, while wider window 135c provides a home location reference. Light blocking selected labels 136 are located between windows 135b and 135c and block windows of a series of windows 135b to thereby customize information onto wheel 135. The details and operation of encoder wheel 135 are described in U.S. patent application Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169, entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device" and form no contribution to the invention of this specification.

FIG. 4 also shows electrical contacts 93, 95 and 97 as they are supported by floor 137 which extends perpendicularly from hopper extension 101a. Vertical ribs 139 extend from floor 137 between contacts 93, 95 and 97 to strengthen the floor 137.

Mounting roller 141a is journaled to hopper extension 99a and symmetrical mounting roller 141b is mounted to hopper extension 101a. Rollers 141a and 141b contact inside surfaces of the cover of cartridge 1, as will be described. Surfaces 133a and 161a (FIG. 5) of hopper 61 rests on rollers in the printer as will be further described.

Hopper end member 101 has an opening receiving a closely-fitting, resilient, cylindrical plug 143. Prior to installing plug 143, toner is loaded into hopper 61 through the open hole, then plug 143 seals the hole.

Photoconductor roller 49 has at its right end a transfer roller drive gear 145, which drives a roller in the printer when cartridge 1 is installed in the printer.

FIG. 5 is a top left rear view with cover elements removed showing more fully the outside of members 99 and 99a of hopper 61. Integral with end member 99 is spacer stud 37a. Under and to the front of stud 37a is spring mounting post 131a, which mounts one end of spring 132a, the other end

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of which is mounted in a hole in member 431 (FIG. 19), which is an inner extension of cover 33 (FIG. 2).

Also integral with end member 99 is perpendicular shield wall 161, which extends downward and rearward to a barrier to physically protect torsional paddle gear assembly 163. The bottom portion of wall 161 forms a flat contact surface 161a to receive a locating roller from the printer when cartridge 1 is installed. The details of paddle gear assembly 163 are not part of this invention and are more fully disclosed in the above-mentioned U.S. patent application Ser. No. 08/602,648, now U.S. Pat. No. 5,634,169.

Gear 49a, integral with the end of photoconductor drum 49, receives power from a meshing gear in the printer when cartridge 1 is installed in the printer. Coupler 41 is integral with developer roller 43 and drives idler gear 165, which drives toner adder roller 45 (FIG. 3) by being meshed with gear 167, which is integral with toner adder roller 45. Coupler 41 receives power from a driver in the printer which is separate from the drive to drum 49, although preferably from a single motor in the printer.

Gear 167 drives the large gear of compound gear 169. Gear 169 drives the large gear of compound gear 171, and gear 171 drives paddle gear 163. A gear plate 173, mounting gears 165 and 169, is mounted on hopper extension 99a by mounting screw 175.

FIG. 5 shows the end of agitator 65 opposite that shown in FIG. 3. That end has a bent portion 65bb to become parallel to extension 101a of end member 101 when it is pivoted to extension 101a on a pin 103b.

Continuing the detailed description of the cartridge incorporating a preferred embodiment of the present invention, FIG. 6 is a top right rear view sectioned near the top similar to the sectioning of FIG. 2. FIG. 6 illustrates more clearly the mounting of doctor blade 91 mounted to press on developer roller 43 under the bias of leaf spring 191. Blade 91 is located on the left rear by tab 361 (best seen in FIG. 14), and on the rear by extension 196a (FIG. 12) of hopper end member 99 which form front and back barriers for holding the left side of doctor blade 91. Similarly, on the right side, two surfaces from 101a, including a rear extension 365 (best seen in FIG. 13) and a front extension 366 (FIG. 13) form front and back holding the right side of doctor blade 91, symmetric to the cage holding the left side of doctor blade 91. The top of blade 91 is held by spring 191. An adhesive tape 192 across the top of the doctor blade 91 bridges over the adjoining horizontal edge of wall 69 (FIG. 2) for sealing, as is conventional.

Spring 191 has blunt ends 191a and 191b, spaced from the center, which contact blade 91 to bias it downward on to developer roller 43. A central ledge 197, integral with ribs 67, forms a cavity receiving the center of spring 191. Horizontal ledges 199a and 199b, opposite central parts of spring 191, formed integral with ribs 67, are horizontal barriers to prevent spring 191 from moving toward the front. Preferably, so as to permit rough handling of cartridge 1 which might occur during shipment, solid upper stop members (not shown) are attached by double sided adhesive on each side between ledges 199a and 199b and the sides 99a and 101a, respectively. These are spaced 0.18 mm above the top of blade 91 and, therefore, contact blade 91 only during rough handling.

FIG. 6 also illustrates posts 141aa and 141bb, which are molded as extensions of members 99a and 101a, respectively, and supporting mounting rollers 141a and 141b, respectively (FIG. 5).

FIG. 7 is a bottom left front depiction of cartridge 1 viewed externally. A series of horizontal depressions 221



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along the back of hopper 61 provide a roughened surface for thumbs when fingers grasp the cartridge through opening 3aa and 3bb. A series of relatively long vertical ribs 223 integral with the bottom of hopper 61 serve as paper and other media guides, while a series of shorter ribs 225, located rearward of the start of ribs 223 and between ribs 223, prevent media snags as media encounter photoconductor drum 49, located immediately after ribs 223 and 225. Past drum 49, media encounter further media guide ribs 227 located on the bottom of shutter 7. FIG. 7 also affords a clear view of idler gear 165 and gear 167.

FIG. 8 is a bottom right rear depiction of cartridge 1 viewed externally. This shows the full right guide wing 9b with enlarged front part 9bb. FIG. 8 shows the right cover elements which were deleted in FIG. 6. A front lower cover section 241 is over much of the encoder wheel 135 and has an access hole 243 for ease of assembly and has an access opening 244 (best seen in FIG. 20). Cover section 241 is stepped outward a small amount to provide room for spring 132b (FIG. 20) to extend between post 131b (FIG. 4) and hole 242 (best seen in FIG. 20). Generally, above and forward of and integral with cover section 241 is cover section 245, which is over the remaining upper front of cartridge 1. Section 245 has a U-shaped housing 247 at its top which traps spacer stud 37b. In the rearward part of section 245 opposite the area above photoconductor drum 49, are located rectangular channels 249 with the second rectangular channel 249a and the last rectangular channel 249b being open to pass air for cooling photoconductor drum 49 during operation of cartridge 1.

The far rear portion 251 of this particular embodiment of the invention herein described mounts links 11b and 17b to shutter 7. A bottom section 253 of the cover located under and forward of passages 249a and 249b mounts the shaft 47 of photoconductor drum 49 and has two upper symmetrical vent holes 255a and 255b to pass air for cooling drum 49.

FIG. 9 is a front right perspective view of the molded plastic member housing 271 which forms the central portion and central extension of hopper 61 with end member 99 attached and agitator 65 installed. It is seen to form a cylindrical chamber with an exit opening formed between wall 69 and wall 61a. An inset 273 at the bottom rear of hopper 61 provides space for rollers in the printer. As best seen in FIG. 2, paddle bar 63a has an inset far left section 63aa to clear inset 273.

Member 271 has a slot 275 around its right side. A directly similar slot is around the left side. End member 101 has a mating ridge 321 (FIG. 13). During manufacture slot 275 is mated with ridge 321 in end member 101 and the two are welded together with ultrasonically created heat. Member 99 is welded to the left side of member 271 in the same manner with ridge 322 (FIG. 12) inserted in a mating slot (not shown) on the left side of member 271.

A notch 277 above agitator extension 65a allows for sufficient rotation of agitator 65 to allow paddle arm 63a to pass beyond extension 65a while preventing a full turn-over of agitator 65.

#### Developer Assembly

The housing 271 and its attached end members 99 and 101, form toner hopper 61. Extension 101a journals toner adder roller 45 and developer roller 43. Gear plate 173, which is attached to extension 99a by screw 175, journals the opposite ends of toner adder roller 45 and developer roller 43. Accordingly, a single unitary assembly is formed of the hopper 61 rearward to and including developer roller 43.

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#### Photoconductor and Cover Assembly

Front cover 25 grips 3a, 3b, left outer cover 33, rear wall 31, (FIG. 1) right cover sections 241, 245, and 251, (FIG. 8) wings 9a, 9b and cleaning chamber 27 are a single molded part. Photoconductor 49 is journaled in this part with its shaft 47 extending past the covers on opposite sides. Shutter 7 is movably supported to left cover 31 and right rear cover 251. Accordingly, a single unitary assembly is formed of the cover members, the photoconductor drum 49 and the shutter 7.

In use, springs 132a and 132b pull the developer roller 43 against the photoconductor drum 49 at a predetermined tension. When cartridge 1 is picked up, the developer assembly and the photoconductor and cover assembly rotate under gravity until stud 37a (FIG. 1) contacts housing 35 and stud 37b (FIG. 8) contacts housing 247, thereby holding the two assemblies together.

#### Lower Shutter as Heat Barrier

Lower shutter 7, when open, covers all of the lower surface of the cleaner chamber. The material of shutter 7 is polycarbonate, a material which deflects heat from the fixing operation which occurs after paper is moved rearward from contact with the photoconductive drum 49. The material of the body of the photoconductor and cover assembly, the hopper 61, end members 99 and 101, and shutter 5 are polystyrene which is lower in cost than polycarbonate would be. The added cost of shutter 7 being polycarbonate is justified by shutter 7 providing heat protection to the cleaner 27 which allows that member to be polystyrene.

#### Agitator Bar System

The toner of cartridge 1 is monocomponent, which can become stagnant and cohesive when left undisturbed for a time. This stagnation and settling of toner may be aggravated by the slight vibrations generated by the printer motor and gear train in a laser printer.

Failure to deliver toner from wall 61a via sloped exit surface 61aaa is the consequence of the settling, stagnation, and cohesive nature of the monocomponent toner in hopper 61. The angle of repose of the settled toner (i.e., the angle of tilt of a surface on which the settled toner rests before it "falls" under its own weight) can reach or exceed 90 degrees. The exiting surface 61aaa is tilted upward at approximately 50 degrees from vertical during operation (angle A, FIG. 9), allowing the toner to stagnate into a pile that does not reach the toner adder roller 45. This leads to premature failure to print, termed "starvation," as would result using an empty cartridge. Experimentally, as much as 230 grams of the 465 gram capacity of hopper 61 of toner have been found in the hopper 61 of a cartridge 1 when starvation has occurred due to existence of a stagnant pile of toner preventing toner delivery to toner adder roller 45.

Agitator bar 65 overcomes toner stagnation and failure to deliver toner to toner adder roller 45. The primary function of agitator bar 65 is to prevent toner stagnation and to deliver toner from the entrance of the developer sump to the toner adder roller thus preventing premature failure to print.

As the hopper paddle 63 rotates counter-clockwise (FIG. 3), it reaches a point in its rotation where it begins to contact extension 65a and lift agitator bar 65. Paddle 63 continues to lift agitator bar 65 until it loses engagement with extension 65a. At this point, the agitator bar 65 falls back via gravity to the resting position, carrying toner from the entry of the developer chamber to the toner adder roller. (Although

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not useful on the disclosed embodiment, an alternative is a pad on extension 65a or on upper wall 61aa which will cushion the fall. Such a pad would also serve as a spacer to control the position of the agitator in the down position and eliminate tab 65b).

At the top of its travel the agitator bar 65 is out of the way of the main sump paddle 63 and approaches a notch 277 in the hopper housing 271 (FIG. 9). Notch 277 provides space for the agitator bar 65 to clear the end of hopper paddle 63, and prevents overtravel of the agitator arm 65, which could cause locking into an up position when the cartridge is shipped, stored, or handled outside of the machine.

In the up position, the agitator bar 65 forms a nearly vertical wall over hopper wall 61a. The initial opening above wall 61a is about 26.7 mm, while the height of bar 65 facing that opening is 7 mm. This allows room for toner from the main sump to flow between the agitator 65 and sloped wall 61aaa. It also serves as a temporary barrier to prevent the delivery of excessive amounts of toner from the hopper 61 to the toner adder roller 45. As the agitator bar 65 falls to its resting position, both newly delivered toner and any stagnant toner resting on wall 61aaa are pushed toward the toner adder roll 45. The motion of the agitator 65 also stirs toner in the area above and toward developer roll to doctor blade nip 91, helping to prevent packing and stagnation of toner in this volume.

The agitator 65, preferably can be implemented by stamping (or laser cutting) and can be formed from sheet metal with spring characteristics that maintain agitator shape during assembly and operation. The entire part comprising bar 65, extension 65a and bent portions 65aa and 65bb preferably can be made by stamping out all features in one operation. As envisioned for the preferred embodiment, illustrated herein, bar 65 may have a length approximately equal to the toner adder roller length, which may be, for example, 220 mm; and have an exemplary height of approximately 7 mm; a thickness of 1.3 mm, chosen to give an agitator mass of the entire part stamped of, for example, approximately 20 grams. Since agitator bar 65 is driven by gravity, the mass is chosen to provide a driving force sufficient to push stagnant toner along wall 61aaa to toner adding roll 45, but the mass is limited so as not to affect the torque sensing function of the hopper paddle 63.

Hinge segments 65aa and 65bb and the associated distance from pins 103a and 103b to agitator bar 65 determine the arc swept by bar 65 as it falls from the up position to the down position. In the present preferred embodiment, pivot distance of 13.5 mm, for example, allows the paddle to sweep from an up position which leaves a gap of 3 mm between the bottom of the bar 65 and the wall 61aa, to a down position 3 mm above the toner adder roller 45. With this design, the weight of the paddle is effectively applied to move toner over the distance swept by the arc. A shorter pivot distance would result in insufficient travel to capture and deliver toner; and would require a heavier paddle to exert the same force on the toner over the distance swept through the arc. Pins 103a and 103b are smaller in diameter (1 mm, for example) than their holes in which they fit in portions 65aa and 65bb to prevent binding due to toner buildup.

Extension 65a is long enough to engage the active segment of paddle 63. Additionally, the length of extension 65a is long enough to overlap the active segment of paddle 63 when extension 65a first engages the paddle 63 to prevent scraping of the paddle surface. A small radius (0.5 mm, for example) is placed on the bottom tip of extension 65a to prevent scraping of paddle 63 as it releases extension 65a.

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The overall length and elasticity of the agitator 65 allows assembly over pins 103a and 103b by simply deflecting the part.

Accordingly, this agitator design functions to overcome toner stagnation and to deliver toner from the entry of the hopper 61 to the toner adder roller 45 active area. The agitator 65 and its extensions 65a, 65aa and 65bb are a single part. Agitator bar 65 is driven internally, with no external gearing, cams, or seals as would be required by an externally driven agitator. Thus gear cost and complexity, seals, friction, and toner leaks are eliminated as problem areas. Agitator 65 is activated frequently enough to move toner and prevent stagnation without adding excessive stirring or damage to the toner. This design enhances first-in, first-out toner delivery from hopper 61 to the smaller area containing the toner adder roller 45 by preventing excessive toner delivery in the raised position and discouraging return toner from the area of the toner adder roller 45 to the hopper 61.

#### Dimensions

With the cartridge installed for operation, the location of the nip of toner adder roller 45 with developer roller 43 is at 105 degrees from vertical. The nip angle of the photoconductor drum 49 to the developer roller 43 is 95 degrees from vertical. As previously stated, the doctor blade nip is at 20 degrees from the vertical.

The length from the bottom of hopper 61 to the horizontal plane coinciding with the edge of top surface 69 near hopper 61 is 61.96 mm, creating an initial opening of about 26.7 mm (as indicated previously, bottom surface 61aa is at 35.3 mm). Top surface 69 has a slight upward angle to a tallest point of 64.34 mm.

The diameter of toner adder roller 45 is 14 mm and it is located with its circumference 1 mm above the bottom of hopper body 271 immediately below it. The diameter of developer roller 43 is 20.11 mm and it is located with its circumference 2 mm above the bottom of hopper body 271 immediately below it. The length from the bottom of hopper 61 to the horizontal plane coinciding with the bottom of developer roller 43 is 23.7 mm, and the corresponding length to the bottom of the toner adder roller 45 is 22.6 mm. The diameter of photoconductor drum 49 is 30 mm.

The bottom of body 271 under rollers 43 and 45 is at a 6 degree upward angle to provide sufficient room for guide ribs 225 on the outside of body 271.

#### Installing the Cartridge

FIG. 10 is a left front view of the inside of a printer with which the inventive cartridge herein described by way of an exemplary preferred embodiment may be used. The cartridge 1 is installed in a printer 291 (FIG. 10) from the front to a final position well within the printer 291. To achieve this, guide wings 9a and 9b are initially guided by a lower track 293 over a curved track, which guides cartridge 1 under the laser printhead (not shown) and over paper feed elements 295.

The path is downward, which utilizes gravity while inserting cartridge 1, thereby easing insertion. The guide 293 (and a guide not shown, which is a mirror image of guide 293 on the opposite side of printer 291) has the same curvature as wings 9a, 9b so that the wings 9a, 9b can follow guide 293 and its opposite guide.

Upper guide 297 is parallel to guide 293. Guide 297 extends further into the printer than guide 293. A guide (not



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shown), which is a mirror image of guide 297, is on the opposite side of printer 291. Guide 297 encounters actuator surface 136b early during the insertion of cartridge 1. As cartridge 1 is moved rearward, actuator surface 136b is rotated to open shutter 7 (as is surface 136a rotated by encountering a mirror image of guide 297 on the left side of the printer). This early movement of shutter 7 is very advantageous in that it eliminates the need for space and mechanism which would be required if actuation occurred at the end of insertion of cartridge 1.

Also shown in FIG. 10 is the right reference position roller 299 on which contact surface 133a rests when the cartridge is inserted. Contact surface 161a will rest on an identical roller (not shown) on the opposite side of printer 291. Rearward of roller 299 is V-block 301, shown more clearly in FIG. 11, and an associated electrical contact 302. Further rearward is an upstanding lug 303, which will contact shutter 7 to hold it open as will be described.

As cartridge 1 is inserted, wings 9a, 9b are guided by guides 293 and 297 and the mirror image guide (not shown) on the opposite side of printer 291. As insertion continues, the wings 9a, 9b fall off the lower guide 293 (and its mirror image guide) and the shaft 47 of photoconductor drum 49 drops into V-block 301 and a mirror image V-block (not shown) on the opposite side of printer 291. A depending thin metal sheet 302 (FIG. 11, shown in side view) is contacted and bent somewhat by shaft 47 as it is guided by V-block 301. This creates a connection for operating potential to shaft 47. When cartridge 1 falls into V-block 301, lug 303 contacts shutter 7 to hold shutter 7 open. Prior to that the longer length of upper guide 297 was sufficient to hold shutter 7 open.

In this final position cartridge 1 is more precisely located with respect to functional elements. Cartridge 1 is held in printer 291 as described below under the heading "Reference Surfaces."

To remove the cartridge, it is grasped by grips 3a, 3b and pulled sharply upward and forward. Wings 9a and 9b again enter between guides 293 and 297, and the cartridge can be pulled free.

#### Manufacture of Cartridge

All molded parts follow the technical dictate (to avoid distortion on cooling) of keeping adjoining surfaces the same thickness. Accordingly, molded studs seen from the rear (shown, for example, in FIG. 13) appear as holes in the part. Circles in the drawings with bowed lines crossing indicate the gate where molten resin was received into the mold (shown, for example, also in FIG. 13).

Assembly of cartridge 1 begins with the joining of hopper body 271 to its end members 99 and 101 with paddle 63 installed. The inside of end member 99 is shown in FIG. 12 and the inside of member 101 is shown in FIG. 13. Both are molded parts of polystyrene resin. Each of the members 99 and 101 is mated to its corresponding side of body 271 (FIG. 9). Ridge 321 of member 101 enters slot 275 on the right edge of member 271. Ridge 322 of member 99 enters slot (not shown) on the left edge of member 271 mating ridge 322. Those parts are held tightly in a fixture and ultrasonically welded, with paddle 63 inserted before the last of the two end members is welded. Then a bushing (not shown) is press fit into the central hole 325 of member 101 around the shaft of paddle 63 and a second bushing (not shown) is similarly press fit around the shaft of paddle 63 in central hole 329.

Agitator bar 65 (FIG. 9) is then flexed and installed by mounting end portion 65aa on pin 103a and end portion 65bb on pin 103b.

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Toner adder roller 45 with low friction washers on each end is then installed by angling its shaft through hole 333 (FIG. 12) in member 99, straightening, and then moving roller 45 laterally to bring its shaft through a press fit bushing (not shown) in socket 335 in member 101.

Prior to installing toner adder roller 45 and gear plate 173, a sickle-shaped seal member having a semicircular central body (not shown) is installed on each side of the location of developer roller 43. Such a seal is illustrated in IBM Technical Disclosure Bulletin, Vol. 33, No. 3B, August 1990, pp. 29-30, entitled "Toner Seal for Printer." The location of this seal on the right side is labeled surface 383 in FIG. 13. This is essentially standard as putty is first applied on each end of the location for the seal and the ends of the compliant elongated seal are pressed into the putty. The seal has ridges directed slightly toward the center. A seal system such as this is essentially the same as previous cartridges.

Doctor blade 91 (best seen in FIG. 6) is then installed by bringing it vertically upward behind ridge 365 (FIG. 13) on the right. In the completed cartridge 1 blade 91 is held on the bottom by contact with developer roller 43. Developer roller 43 with low friction washers on each end is installed by positioning the left end of its shaft past end member 99 (FIG. 12) and threading the right end of its shaft through the central hole of the bushing 375, shown in FIG. 15.

Gear plate 173 is shown alone in FIG. 14. It has a hole 351 to receive the shaft of toner adder roller 45 and hole 359 for shaft of developer roller 43. A central hole 353 is to receive screw 175 but hole 353 is significantly larger than the shaft of screw 175. Gear plate 173 has a shaft 355, a shaft 357, and a rightwardly extending tab 361.

Gear plate 173 is brought toward member 99 while the shafts of toner adder roller 45 and developer roller 43 are positioned through holes 351 and hole 359 respectively. Gear plate 173 is rotated until tab 361 abuts the edge of doctor blade 91. This serves as a locator for gear plate 173 and doctor blade 91. Screw 175 is then tightened in hole 353 to fix plate 173 in that position.

Gears 169, 165 and 171 are pressed on shafts 355, 357 and 363 (FIG. 5, on member 99). (As is shown in FIG. 14, such shafts have an enlarged head with a gap so as to be yieldable when receiving a press-on force.) A gear 167 is also pressed on the shaft toner adder roller 45. Paddle gear assembly 163 is pressed onto the shaft of paddle 63. These gears and drive coupler 41 are keyed to their shafts by the two having matching "D" cross sections.

Bushing 375 has a flat outside segment 377 which permits bushing 375 to enter opening 379 (FIG. 13) in member 101 since opening 379 is circular with an open less-than-one-half circle segment in which bushing 375 can fit at one orientation. Bushing 375 is then rotated in a direction to rotate lower tab 381 downward, which removes the orientation at which bushing 375 can fit through the incomplete segment of 379 and locks bushing 375 into place. Bushing 375 installed is shown in FIG. 16. In operation, developer roller 43 rotates in a direction to rotate tab 381 downward. The advantage of bushing 375 is that it provides for relatively easy installation and change of developer roller 43 in the event that a member requires replacement during subsequent tests.

Drive coupler 41 is then press fit on the left end of the shaft of developer roller 43 using a locating shim to space coupler 41 slightly from cover 31. Mounting rollers 141a and 141b are previously applied by press fit during completion of the hopper 61. An adhesive tape is applied across the

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top of doctor blade 91. Spring 191 is then flexed into place to bias doctor blade 91 downward. After toner is installed and leak tested, the previously mentioned upper stop members on each side of ledges 199a and 199b are applied individually and remain in place, held by their back adhesive layer. Also encoder wheel 135 is installed by press fit.

With rollers 43 and 45 and doctor blade 91 in place, metal contact 93 is inserted between ribs 139. Contact 93 has arrowhead sides to bind into ribs 139, and extends upward and over two posts 385 (FIG. 4) in member 101a and extends to a bent end which presses against doctor blade 91. Contacts 95 and 97 similarly have arrowhead sides which dig into ribs 139 and terminate in short bent ends 387, 389, respectively, which press against the shafts of roller 45 and 43, respectively. Contact grease is added to contacts and shafts.

The foregoing all are part of the developer assembly. The photoconductor and cover assembly is separately assembled. The cleaner blade panel 73a (see FIG. 3) is installed using screws 77a and 77b. Link arms 11a, 11b, 17a, 17b and 15a, 15b are assembled in a known manner by studs having extensions which enter matching holes in adjoining arms. The arms are then rotated to operating positions in which the extensions find no opening and therefore lock the members together while leaving them free to rotate. Links 13a to 11a and 13b to 11b are held by a pin 401 with latch, as shown in FIG. 17.

Pin 401 has a circular flexible arm 403 and latches 11a and 11b have a matching ledge 405b (the ledge on the opposite side not shown). Pin 401 is inserted through the holes of member 13a and 11a and another pin 401 is inserted through the holes of members 13b and 11b. The pins 401 are then rotated until their arms 403 flex around ledge 405b and the ledge on the opposite side, respectively, and then recover to latch under ledge 405b and the ledge on the opposite side, respectively. This holds both four bar linkages in place. Pin 401 has a shaft 407 (best seen in FIG. 4), which extends into a groove (not shown) on each side of cleaner 27 for added stability of each four bar linkage.

Shutter 7 is installed by flexing shutter 7 and locating pins 431b (FIG. 1) and a pin on the opposite side (not shown) and inserting pin 431b and the pin on the opposite side in holes in the sides of locator surface 29a, 29b, respectively. Pin 431b has a coil compression spring 433 wrapped around it which is tensioned to bias cover 7 upward.

As best seen in FIG. 19, one end of spring 132a is attached through a hole of connector tab 431 of cover 33 on one side and the opposite end of spring 132a is temporarily attached to hole 39a of cover 33. As seen in FIG. 20, spring 132b is attached through a hole of connector tab 242 of cover 241 on one side and the opposite end of spring 132b is temporarily attached to hole 243 of cover 241.

The photoconductor drum 49 is installed into the cleaner housing assembly by placing the drum and the two gears 49a and 145 (see FIGS. 4 and 5) in position with a thin washer, (not shown) on the left side and inserting shaft 47 through that assembly and the housings 31 (FIG. 2) and 253 (FIG. 8). Standard E-clips are installed on each end of shaft 47 to hold the drum and shaft from lateral movement. As shown in FIG. 18, an extending hub 145a of gear 145, has an internal copper sheet 421 with three sharp points 421a. Copper sheet 421 also has an elongated member 421b extending to over the central hole. Hub 145a is inserted inside drum 49. Points 421a dig into the aluminum cylinder which forms the inside of drum 49, creating both physical and electrical connection. Shaft 47 is then threaded through gear 145, drum 49 and then

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through gear 49a. This bends elongated member 421b so that it presses against shaft 47 and makes electrical contact.

The developer assembly is then placed before the photoconductor and cover assembly and the two are moved together. Covers 33 and 241, 245 flex outward and then close into the final position. Springs 132a and 132b are removed from holes 39a and 243 and manually attached to studs 131a and 131b respectively. This completes the cartridge 1.

It will be readily understood that any joint where toner is contained must be sealed. Immediately inside the bearings of toner paddle 63 and toner adder roller 45 synthetic rubber end seals are located. FIG. 13 shows a socket 335 having upper and lower tabs which receive such a seal, the seal having matching extensions which fit in the tabs to prevent rotation of the seal. The ends of the chamber of cleaner 27 have foam walls with outer adhesive to secure their positioning. As is previously known, other extended joints have a plastic (polyethylene terephthalate) tape with one side carrying pressure sensitive adhesive applied along them by the adhesive. As is also previously known, developer roller 43 is sealed with a tape which is cantilevered up from the bottom of body 271 to be located in front of the roller 43. A second adhesive strip seals the far rear edge of body 271. Such sealing is basically standard and forms no part of this invention.

#### Toner

In a preferred embodiment cartridge 1 employs monocomponent electrophotographic toner which may be basically conventional. The amount of toner in hopper 61 is limited by pressure impairing print quality and sensing of toner level by toner resistance on paddle 63. When cartridge 1 is in the installed position, a typical top level of toner will be 10 mm above the upper barrier wall 61aa. The presence of toner at that typical highest level is indicated in FIG. 9 by surface lines 425, but the toner is shown otherwise as transparent for clarity. The actual toner is, of course, an opaque, dry powder. During use, the toner is depleted to lower levels and it is moved by paddle 63. As is conventional, developer roller 43 applies toner 425 to photoconductor drum 49 to develop electrostatic images on photoconductor drum 49.

#### Reference Surfaces

FIG. 19 shows just the roller 141a of the hopper assembly as finally installed and, therefore, located on a flat surface 441 which is an extension of the cover 33. Similarly, FIG. 20 shows just the roller 141b of the hopper assembly as finally installed and therefore located on a flat surface 443 which is an extension of cover 241. Such positioning of an assembly with the photoconductor roller and an assembly with the developer roller for lateral adjustment for rollers is essentially the same as in prior cartridges.

However, in the described embodiment of the present cartridge, cartridge 1 has flat surfaces 133a and 161a and the printer 291 has the second set of rollers (roller 299, FIG. 10 and its mirror image), on which flat surfaces 133a and 161a, respectively, rest. In the prior cartridges a second set of rollers was part of the cartridge. As in the prior cartridges the two sets of rollers 141a, 141b, 299, and the mirror roller image of 299, define a plane of movement to guide the developer roller 43 into the intended contact with photoconductor drum 49.

FIG. 19 shows tab 23, which is an extension of cover 33 and, when the cartridge 1 is installed in a printer as shown in FIG. 19, is generally above a flat surface 445 of the frame

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of the printer. Similarly, as shown in FIG. 20, a top flat ledge 447 is an extension of cover 241 and, when cartridge 1 is installed in a printer, is above a flat surface (448 of FIG. 10) of the frame of the printer.

A flat bottom surface 449 (FIG. 19) is under tab 23 of cover 33, and a flat bottom surface 451 (FIG. 20) of cover 245 is under ledge 447. Bottom surfaces 449 and 451 are locator surfaces which rest on frame surfaces 445 and 448, respectively.

FIG. 21 shows the right side of cartridge 1 installed in a printer with emphasis on cantilevered roller 461 pressing down on locator surface 29b. A second cantilevered roller (not shown), which is a mirror image of roller 461 exists and presses down on locator surface 29a. Roller 461 and its mirror image roller are attached to the frame of the printer. They are firmly biased downward by a coil spring 463 for roller 461 and a mirror image coil spring for the mirror image roller. As the cartridge 1 is inserted in the printer by movement of wing 9a in guides 293, 297 and wing 9b in corresponding mirror image guides, locator surface 29b encounters cantilevered roller 461 and locator surface 29a encounters a corresponding mirror image cantilevered roller; and the locator surfaces 29a, 29b rotate those rollers upward as the cartridge 1 continues to move.

When wing 9a falls off of guide 293 and is finally positioned by shaft 47 settling in V-block 301, cantilevered roller 461 fully contacts surface 29b, as shown in FIG. 21. When the top cover of the printer is closed, a downwardly positioned leaf spring on the printer cover contacts tab 23 on the left front of cover 33 and a second downwardly positioned spring on the printer cover contacts surface 447 on right cover 241. Such interaction of a cartridge with a printer lid is generally conventional, as illustrated by U.S. Pat. No. 5,365,315 to Baker et al.

As the printer lid is closed, a charge roller mechanism is moved to shutter 5 and then continues to move downward to open shutter 5 by pushing it downward and to bring a charge roller in contact with photoconductor 49. A laser beam for discharging drum 49 is also directed through the opening left after shutter 5 is pivoted down, as is shown on U.S. Pat. No. 5,526,097 to Ream.

In summary, the photoconductor and cover assembly is located downwardly by front surfaces 449 and 451, is located downwardly by shaft 47 in V-block 301 and in the mirror image V-block and is held in the downward location by cantilevered roller 461 on surface 29b and the mirror image cantilevered roller on surface 29a. The developer assembly is located laterally by springs 132a and 132b moving the assembly so that developer roller 43 contacts the photoconductor 49, and is located downwardly by ledge 133a resting on roller 299 and ledge 161a resting on the mirror image roller to roller 299. The developer assembly requires no upward locator as it has sufficient weight not to displace upward.

Ledges 133a and 161a resting on roller 299 and a mirror image roller respectively permit the developer assembly to adjust laterally. In prior cartridges, both sets of rollers were in tracks in the cartridge. This required difficult tolerances to locate the bottom of the cartridge within the printer. In the subject cartridge, ledges 133a and 161a have no linked parts to the media guide ribs 223 and 225, which are in the same molded part as ledges 133a and 161a.

FIG. 22 shows an extension of side member 99 held in a slot 471 in the bottom of the cover 25. This provides lateral location between the hopper assembly and the cover 25. Generally similar lateral location structure is in previous

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cartridges. If desirable, the upper parts of end members 99 and 101 and have an upward ridge or bump, which will strike cover 25 during rough handling and thereby limit relative upward movement of the hopper assembly with respect to cover 25.

When installed in the printer, frame members contact left cover 31 and right cover 241 to assure they do not contact the hopper assembly and interfere with its free movement over roller 299 and its mirror image roller on ledges 133a and 161a respectively.

#### Venting By Plug

Plug 143 (FIG. 24) in a preferred form is a venting element which allows air to escape cartridge 1 while blocking toner. Cartridge 1 in the embodiment disclosed is designed to operate at high speed to print from 8 to 24 or more standard pages per minute. This operation generates a potentially detrimental internal pressure level during operation, which contributes to leaks of toner from cartridge 1. To relieve such pressure, plug 143 is a labyrinth design ending in a felt filter.

The leaks often, but not exclusively, occur immediately after the cartridge becomes inactive. Internal pressure in hopper 61 is created by ingesting air with toner 425 carried by the developer roller 43 past a seal (not shown) under the developer roller 43. The toner adder roller 45 pulls this air/toner mixture away from the developer roller which creates a pressure increase in hopper 61 until an equilibrium pressure is reached. As shown in FIG. 23, plug 143 is formed from a single molded part 481 having a circular base member 483 and a circular cap member 485 separated by a thin connecting arm 487, which has a central notch 489 to permit bending as a solid hinge.

Base 483 has a series of equally separated external holes 491 around the entire bottom circumference of base 483. Extending from the bottom of base 483 and located inward is a circular wall 493 having spaced rectangular openings 495 at the outer end of wall 493 equally spaced around the entire circumference of wall 493.

Similarly, cap 485 has a circular wall 497 extending from the top of cap 485 having spaced rectangular openings 499 at the outer end of wall 497 equally spaced around the entire circumference of wall 497. A disk 501 of standard F3 felt is pressed into the center of cap 485 where it contacts the inside of holes 503 (FIG. 24) in the center of cap 485.

To complete plug 143 as shown in FIG. 24, cap 485 and base 483 are intermeshed by folding arm 487 at hinge point 489. In this position no part of openings 499 is opposite external holes 491 and no part of openings 495 is opposite holes 499. FIG. 25 is a staggered cross section view of FIG. 24 which shows all of the holes 495 and 499 and indicates the staggered path by the angles 505a and 505b in discussion arrow 505.

As shown in FIG. 25, the plug is held together by a press fit in which the bottom circumference of base 483 is slightly smaller than the circumference of cap 485. In operation, when pressure increases in cartridge 1, air, potentially containing toner particles, enters openings 491 which are inside of hopper 61. That air enters circular chamber 507, as illustrated by arrow 505, and is blocked by wall 497 immediately opposite hole 491 and, therefore, must move right or left, as illustrated by bent arrow 505a, to reach openings 499. The air then enters chamber 509. That air is blocked by wall 493 and also must move right or left, as illustrated by bent arrow 505b, to reach openings 495, which are on the opposite end of chamber 509. Upon passing through open-



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ings 495, as shown by arrow 505, the air enters central chamber 511 and passes through felt filter 501 and then out of cartridge 1 through holes 503. (FIG. 23 shows four central flanges 513a-513d, which divide chamber 511 into four equal parts. However, flanges 513a-513d are for structural support of felt disk 501 and, functionally, chamber 511 can be a single chamber.)

The labyrinth configuration of this construction of plug 143 results in continuing operation as an air vent with only minor accumulation of toner inside of the plug 143. The internal chambers 507, 509 and 511 are concentric circles.

We claim:

1. A toner cartridge for an imaging apparatus comprising a toner hopper,
  - a developer roller which receives toner in controlled amounts from said toner hopper, and
  - a photosensitive roller which is toned by toner delivered by said developer roller,
- said cartridge having curved planar members on opposite sides of said cartridge for guided movement by slots in said imaging apparatus, said planar members being substantially continuous for being guided by substantially continuous slots,

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said planar members being thin at their initial locations of entry into said slots and said planar members being continuous with a member of a larger thickness at locations spaced from said initial locations so that entry in said slots is facilitated by said initial locations being significantly thinner than the width of said slots.

2. The cartridge as in claim 1 in which each said planar member is plastic molded as a unitary member including the body of said cartridge from which each said planar member extends.

3. The toner cartridge as in claim 2 in which said hopper contains electrophotographic toner for developing electrostatic images.

4. The cartridge as in claim 1 in which each said planar member is plastic molded as a unitary member including the body of said cartridge from which each said planar member extends.

5. The toner cartridge as in claim 4 in which said hopper contains electrophotographic toner for developing electrostatic images.

6. The toner cartridge as in claim 1 in which said hopper contains electrophotographic toner for developing electrostatic images.

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**United States Patent** [19]**Coffey et al.**[11] **Patent Number:** **5,802,432**[45] **Date of Patent:** **Sep. 1, 1998**[54] **TONER CARTRIDGE WITH HOUSING AND PIN CONSTRUCTION**

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[51] **Int. Cl.** <sup>6</sup> ..... G03G 21/18

[52] **U.S. Cl.** ..... 399/110; 399/113

[58] **Field of Search** ..... 399/110, 111, 399/113, 119

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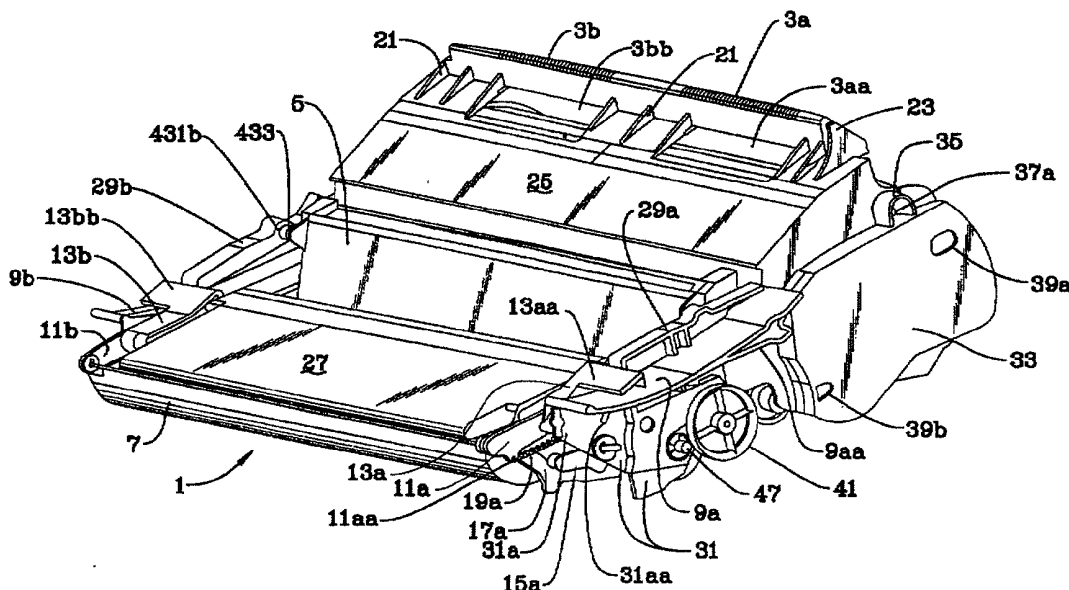
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*Primary Examiner*—Joan H. Pendegrass

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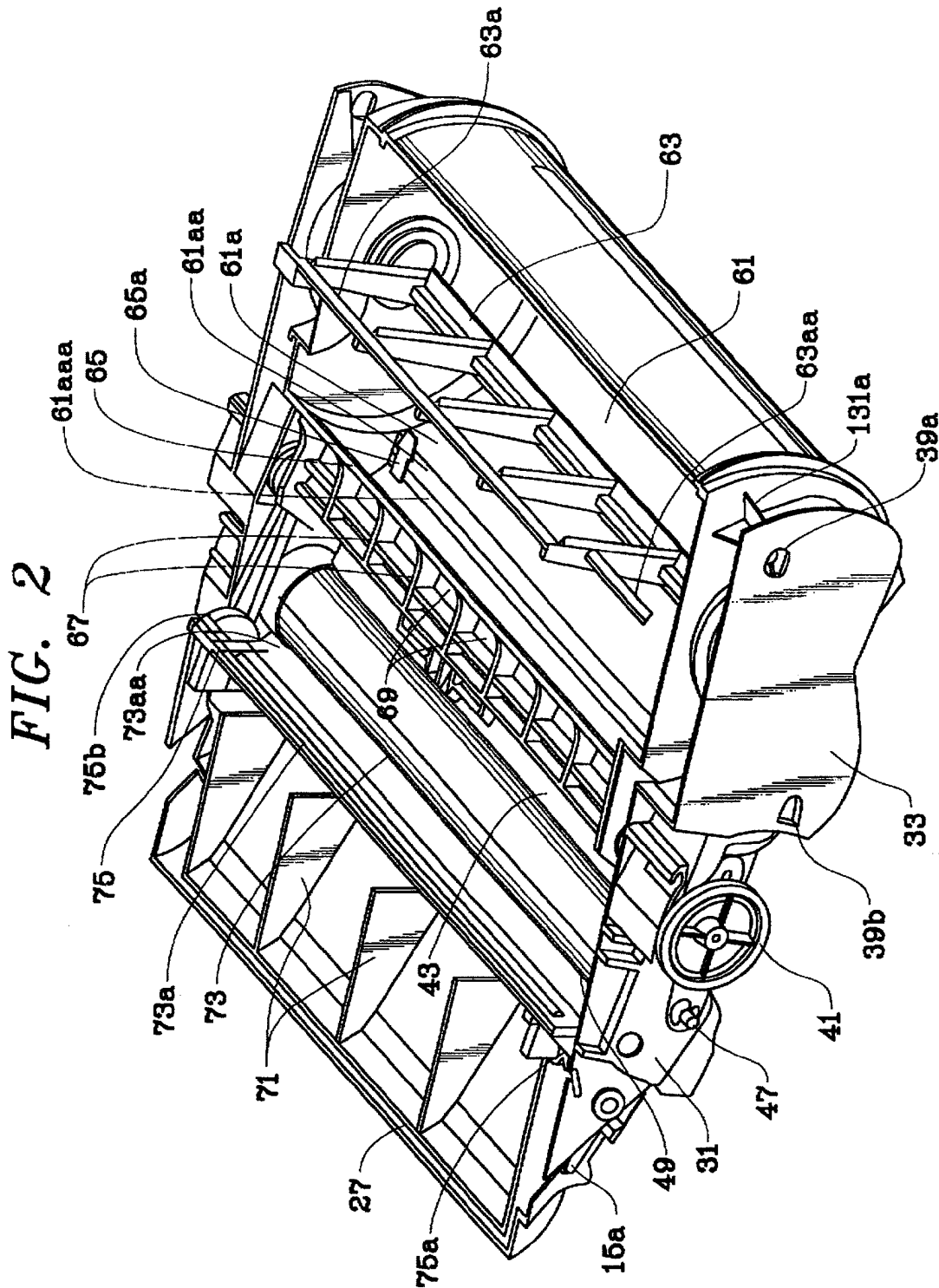
[57] **ABSTRACT**

Toner cartridge (1) has a unitary assembly forming the handle (3a, 3b), the cover (25), side walls (33, 245) and the cleaner chamber (27) and hold the photoconductor drum (43). Each of the side walls has a U-shaped housing (35, 247) which loosely receives a pin (37a, 37b) from the side of the hopper (61). The hopper is part of a unitary assembly holding the toner adder roller (45) and the developer roller (43). Second pins (131a, 131b) from the sides of the hopper carry springs which pull the two assemblies together to press the developer roller against the photoconductor. The hopper also has flat ledges (161a, 133a) on each side for movement on roller in the printer. This further permits the cartridge to have central locating elements (29a, 29b), wing-like guides (9a, 9b) for insertion, links (13a, 13b) to open a lower shutter (7), and unobstructed ends of photoconductor shaft (47) for positively locating on that shaft.

**10 Claims, 23 Drawing Sheets**









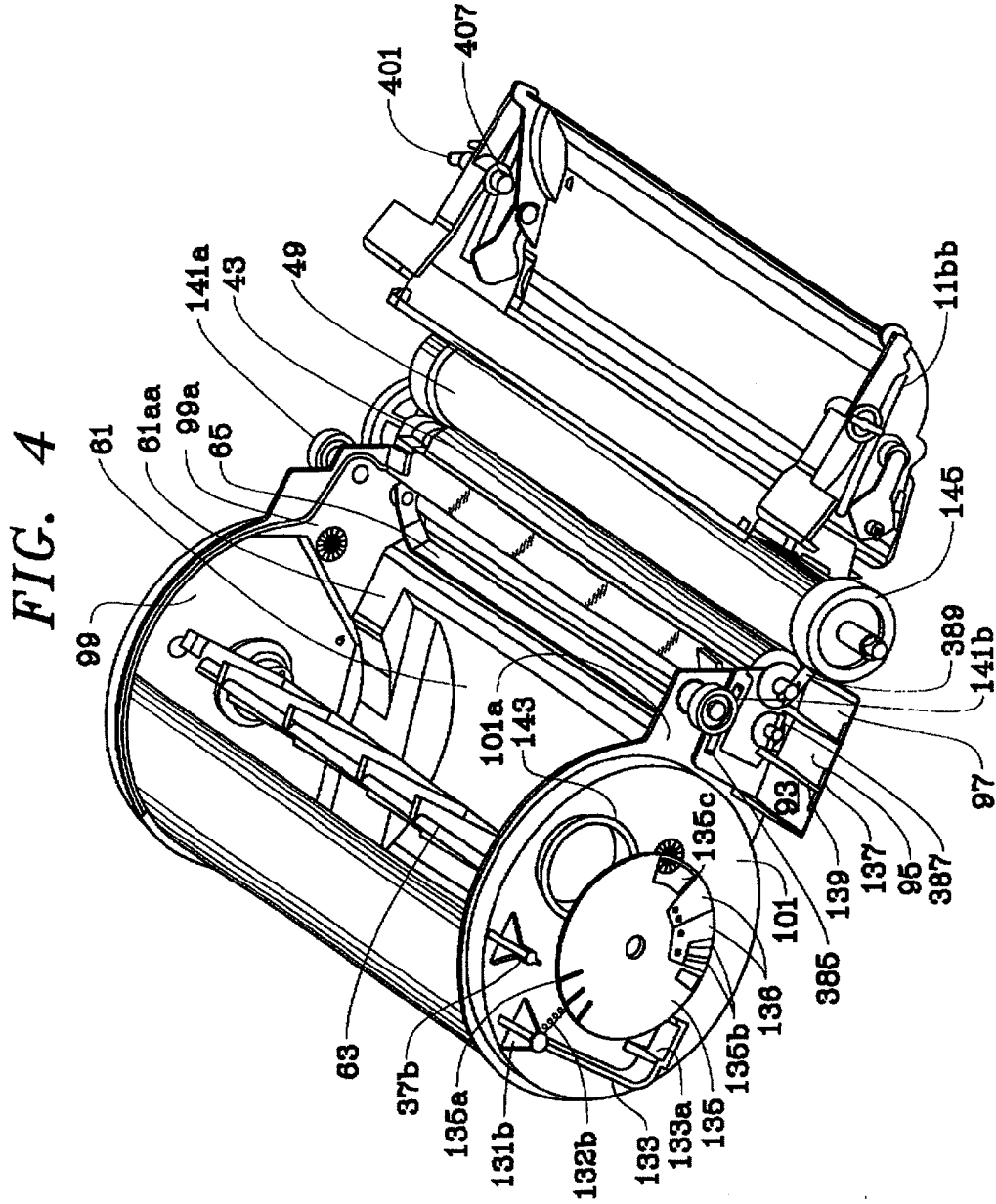




FIG. 6

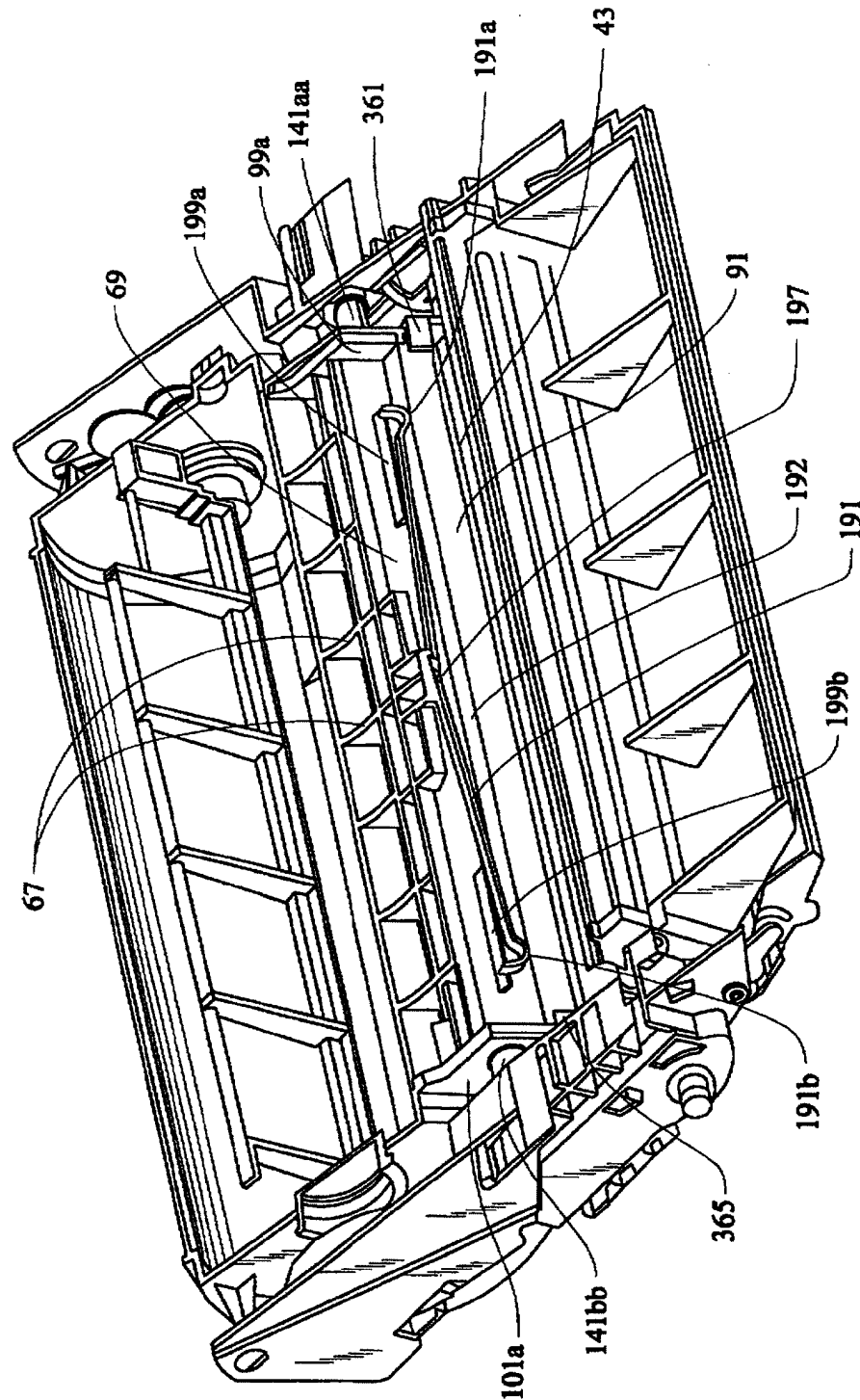
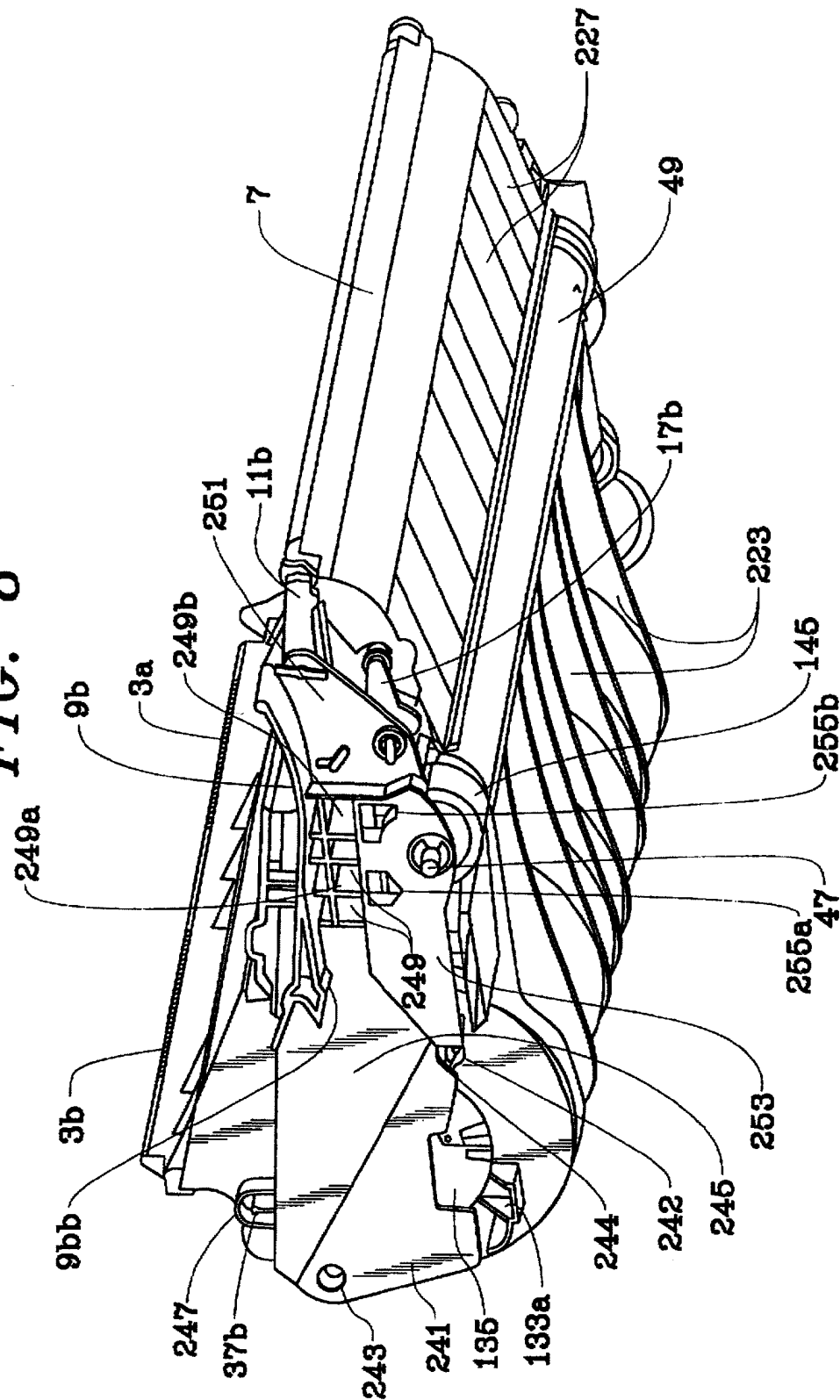




Fig. 1 is a perspective view of a portable electronic device, such as a PDA or a thin client. The device features a curved display screen (165) and a mechanical assembly (167) that includes a circular component (166) and a lever (168). The device is shown in a closed position, with the display screen (165) and the mechanical assembly (167) visible. The device is labeled with various reference numerals: 3a, 3b, 3bb, 61, 221, 223, 225, 49, 167, 165, 227, and 7.

FIG. 8



**FIG. 9**

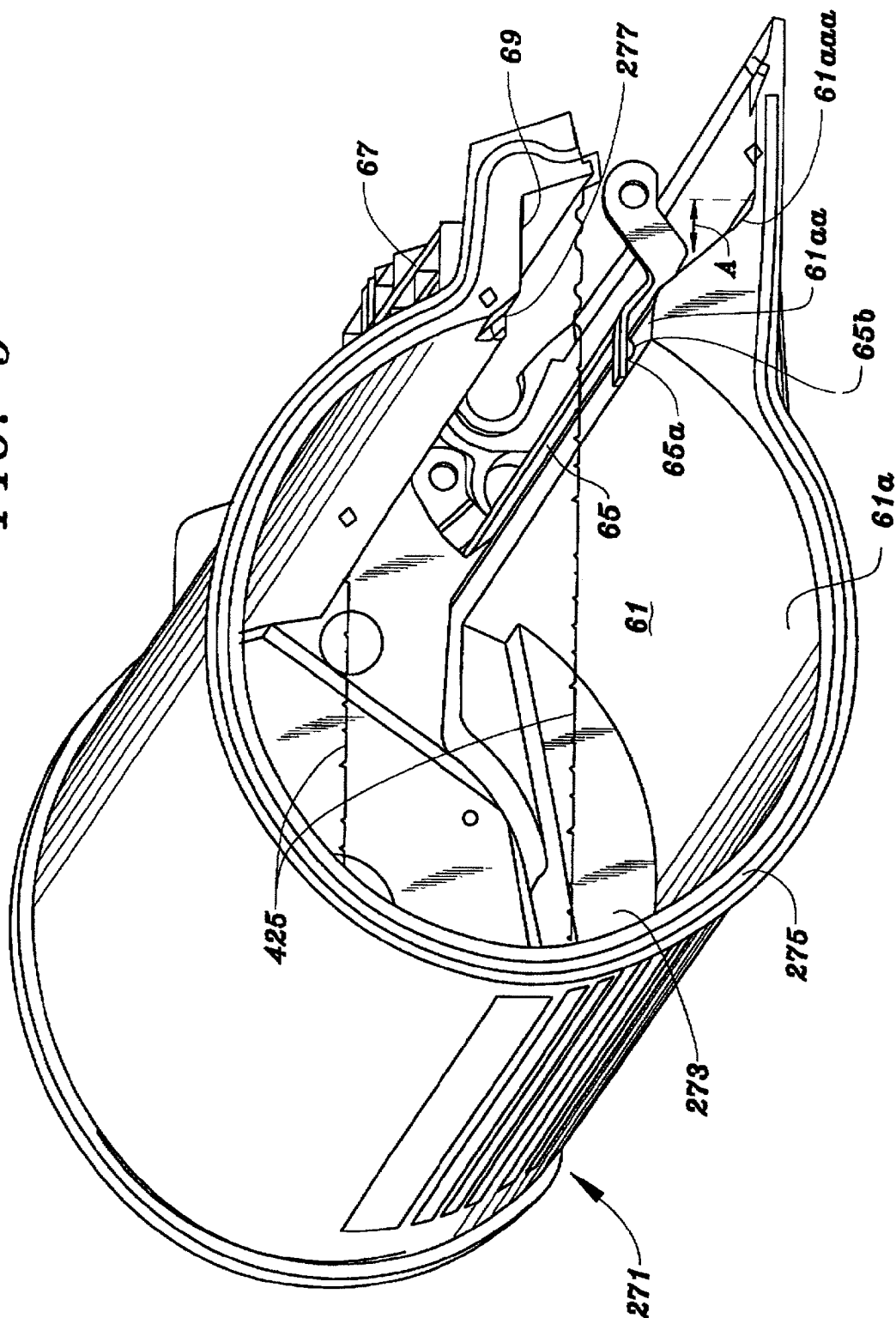


FIG. 10

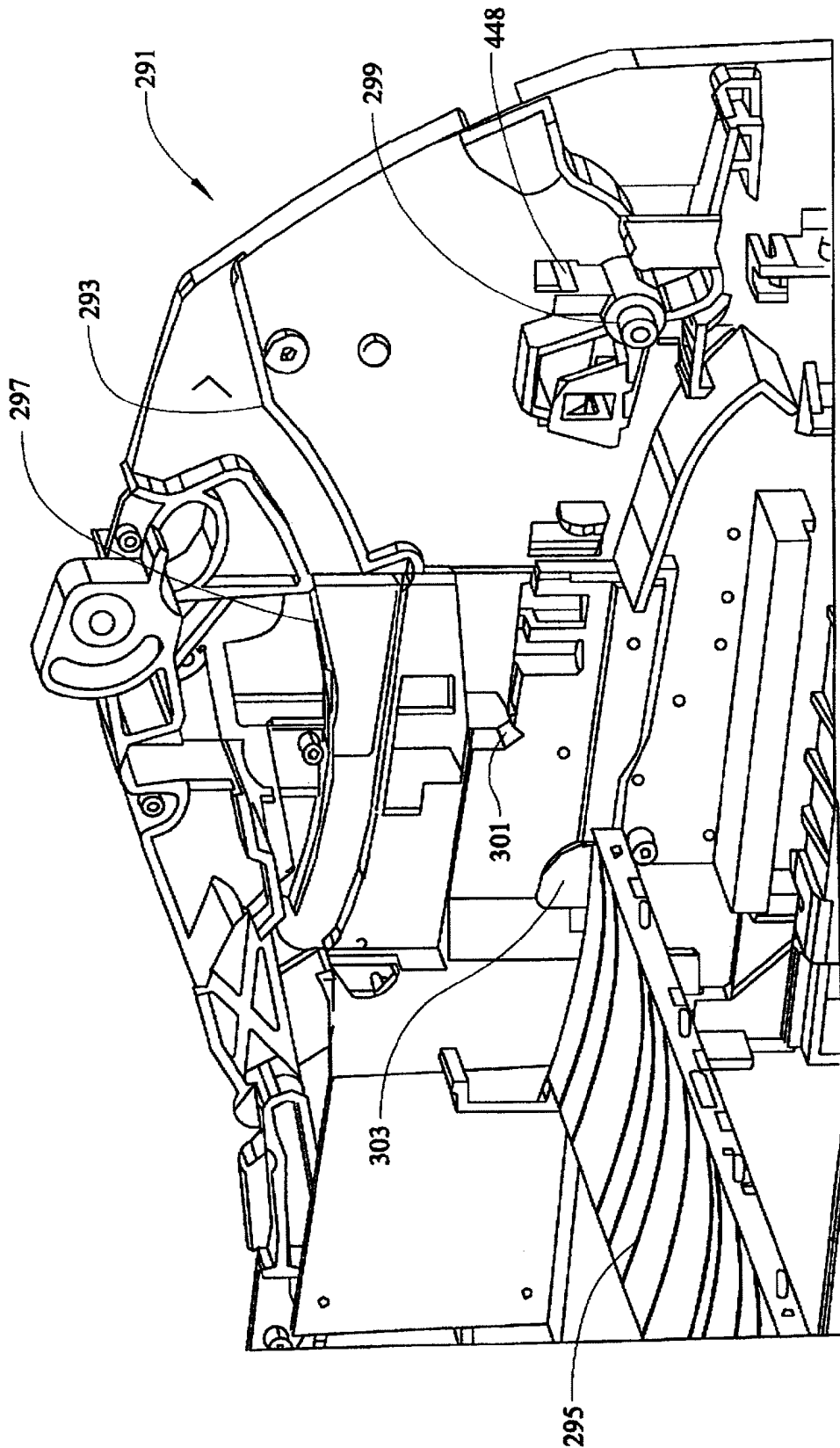
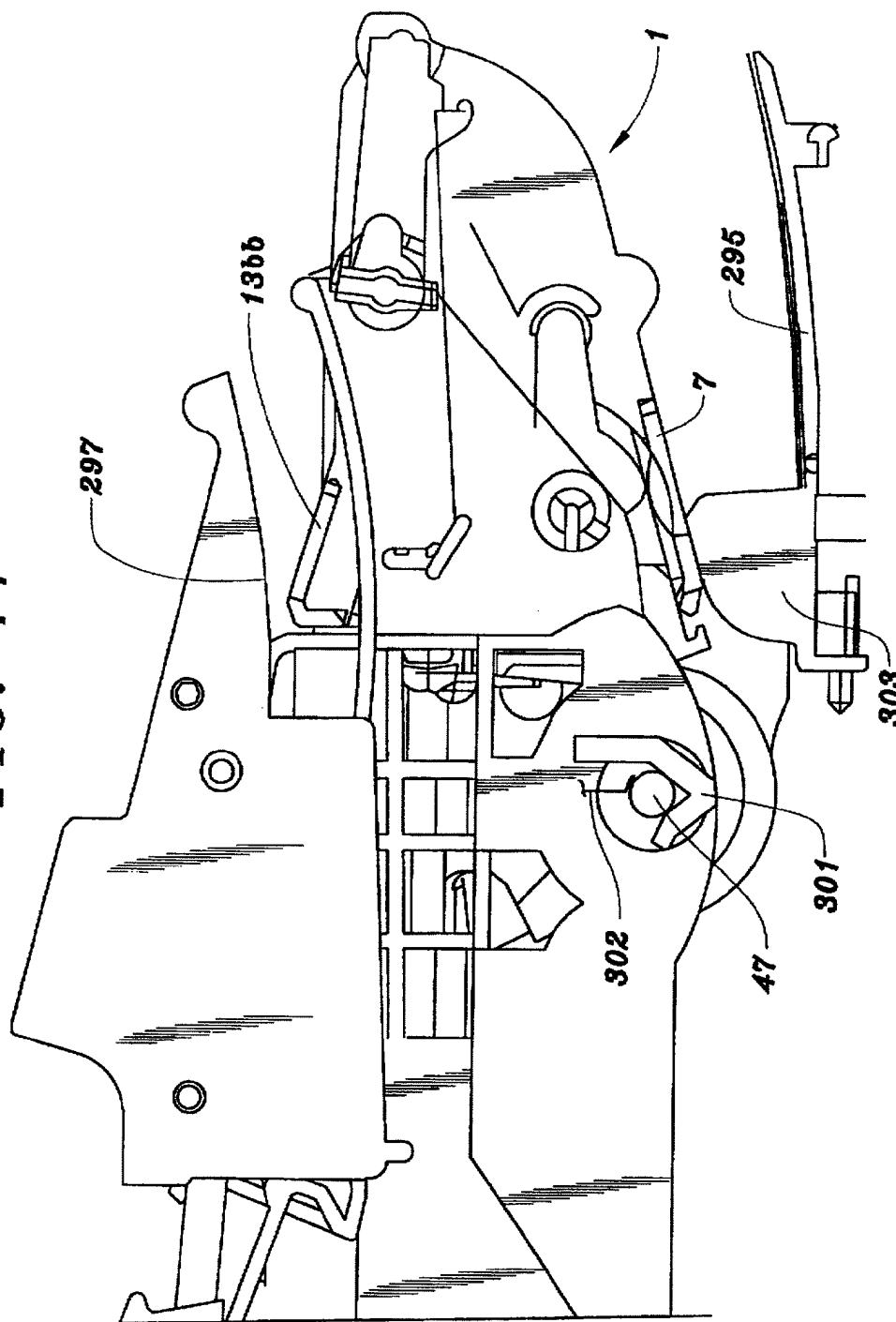
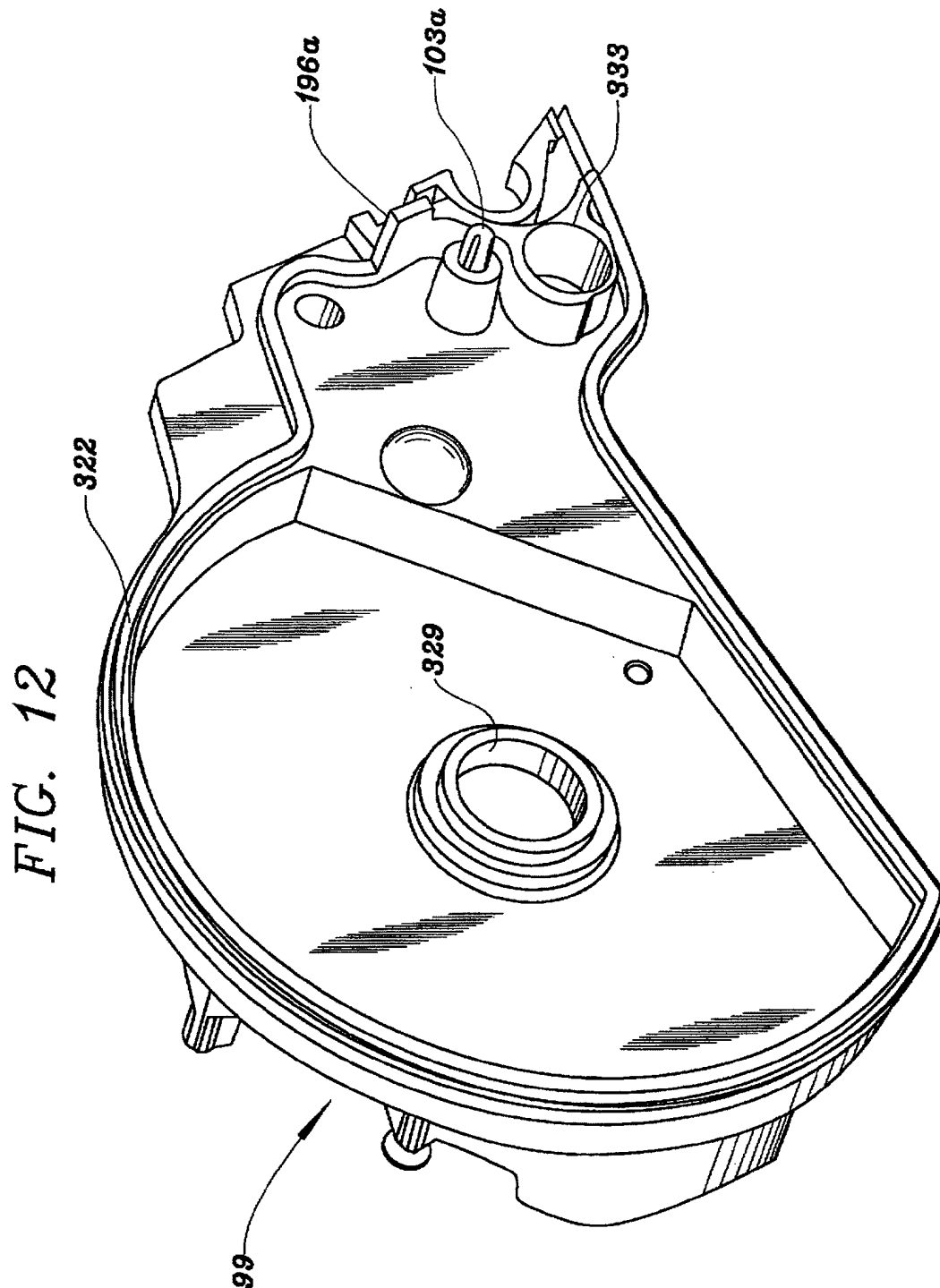
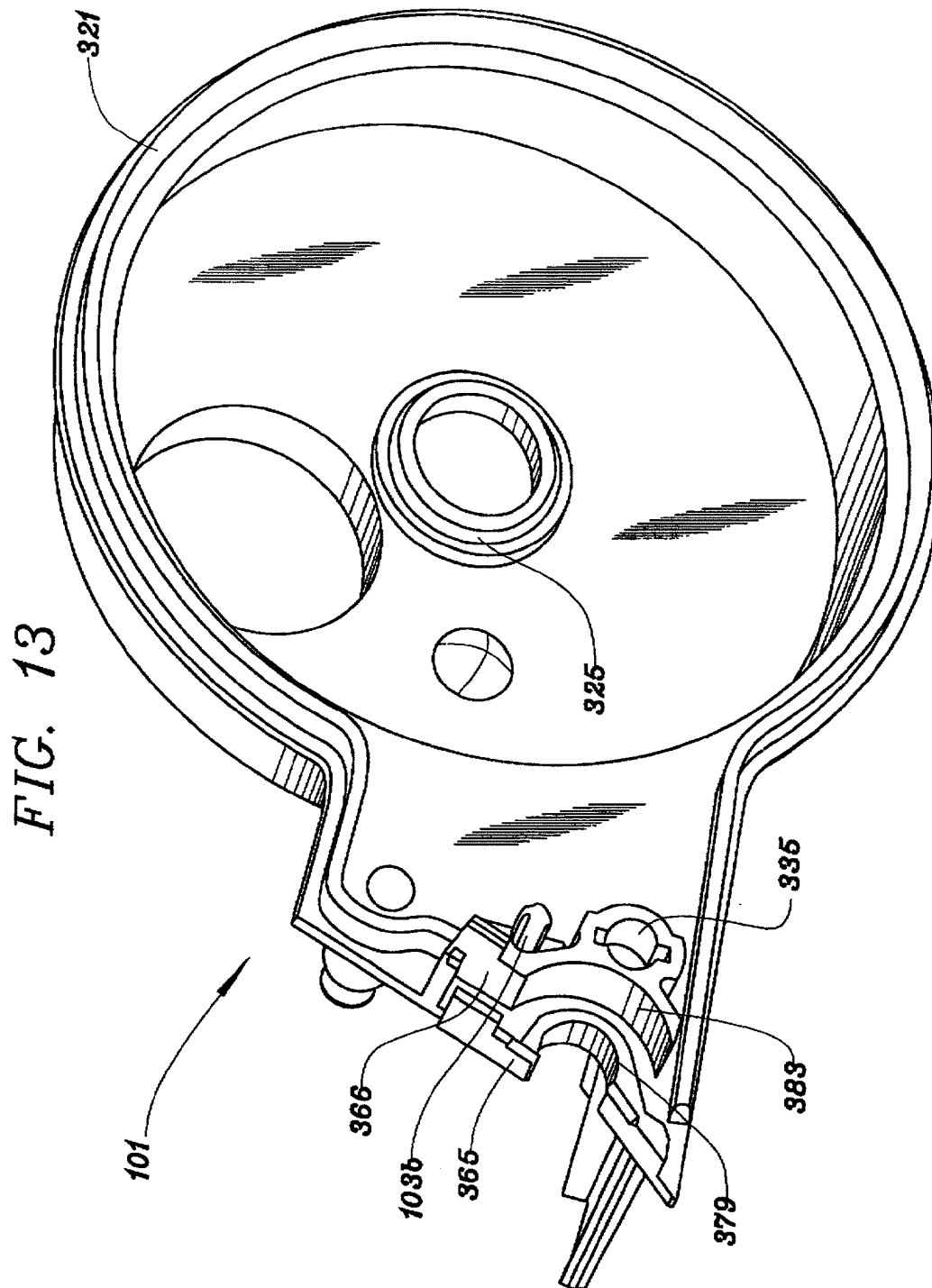


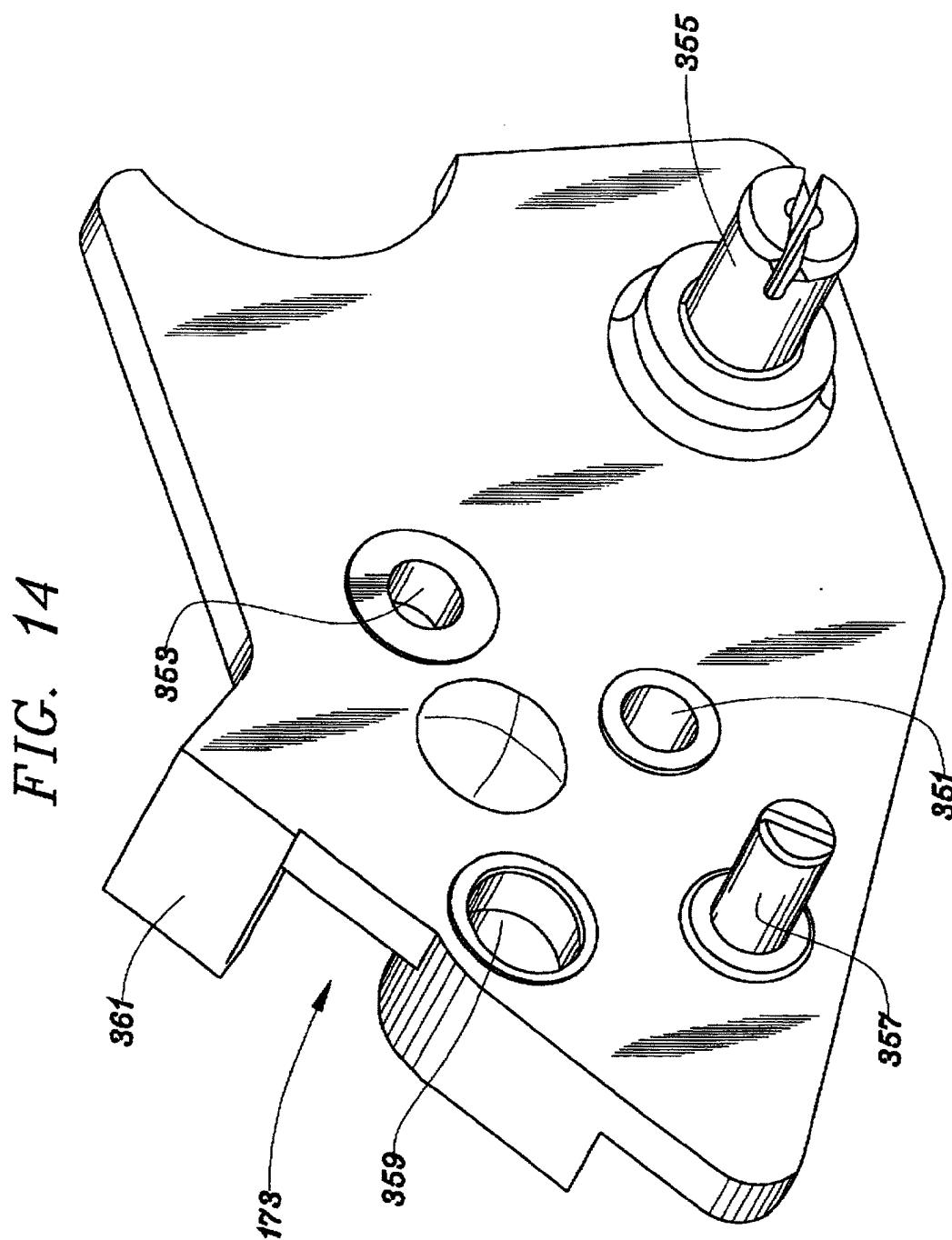
FIG. 11



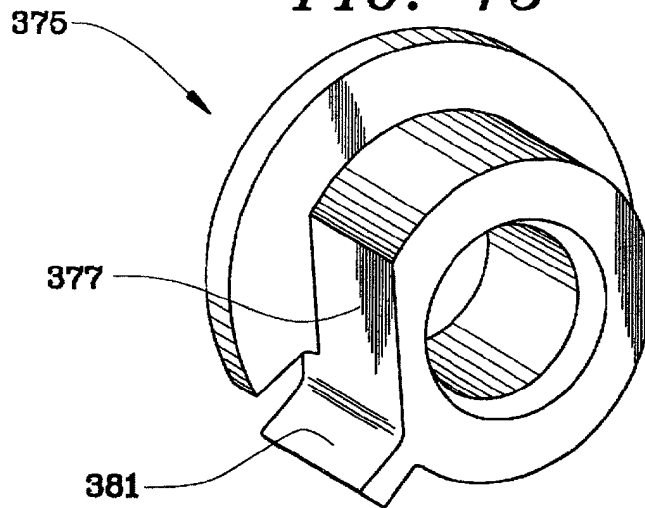








*FIG. 15*



*FIG. 18*

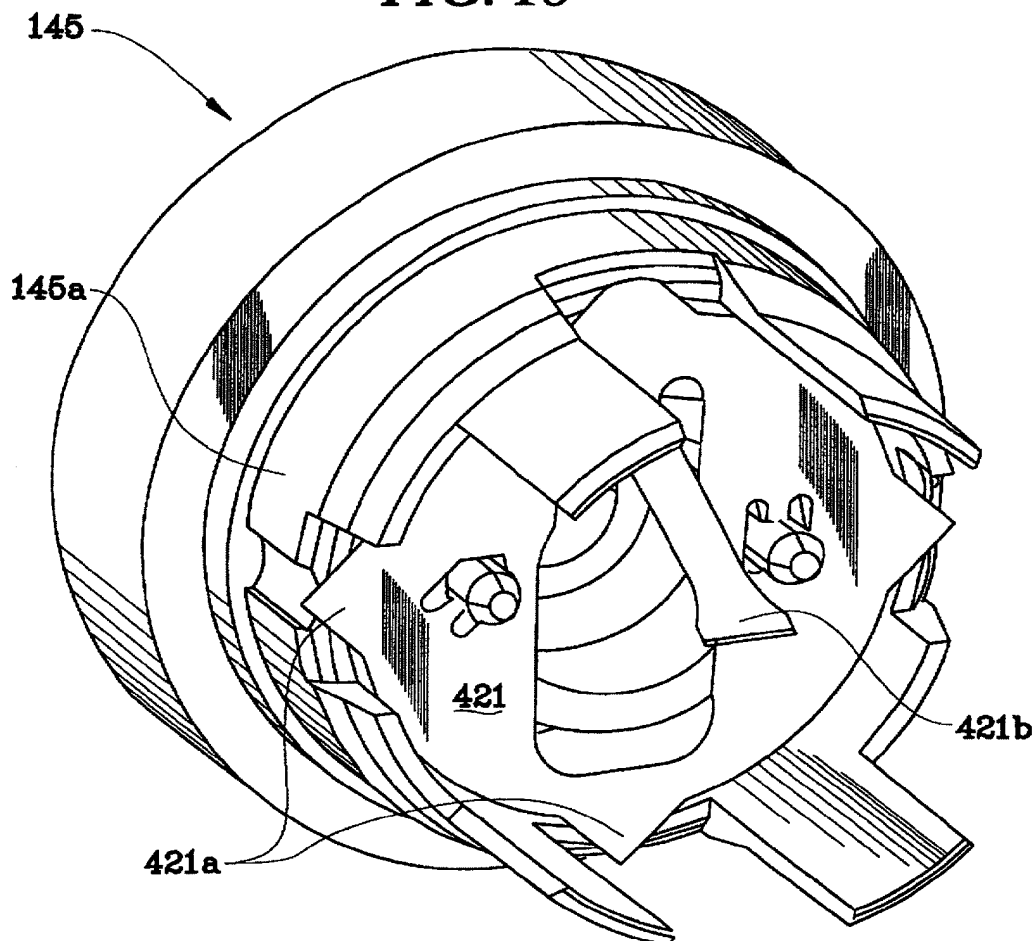


FIG. 16

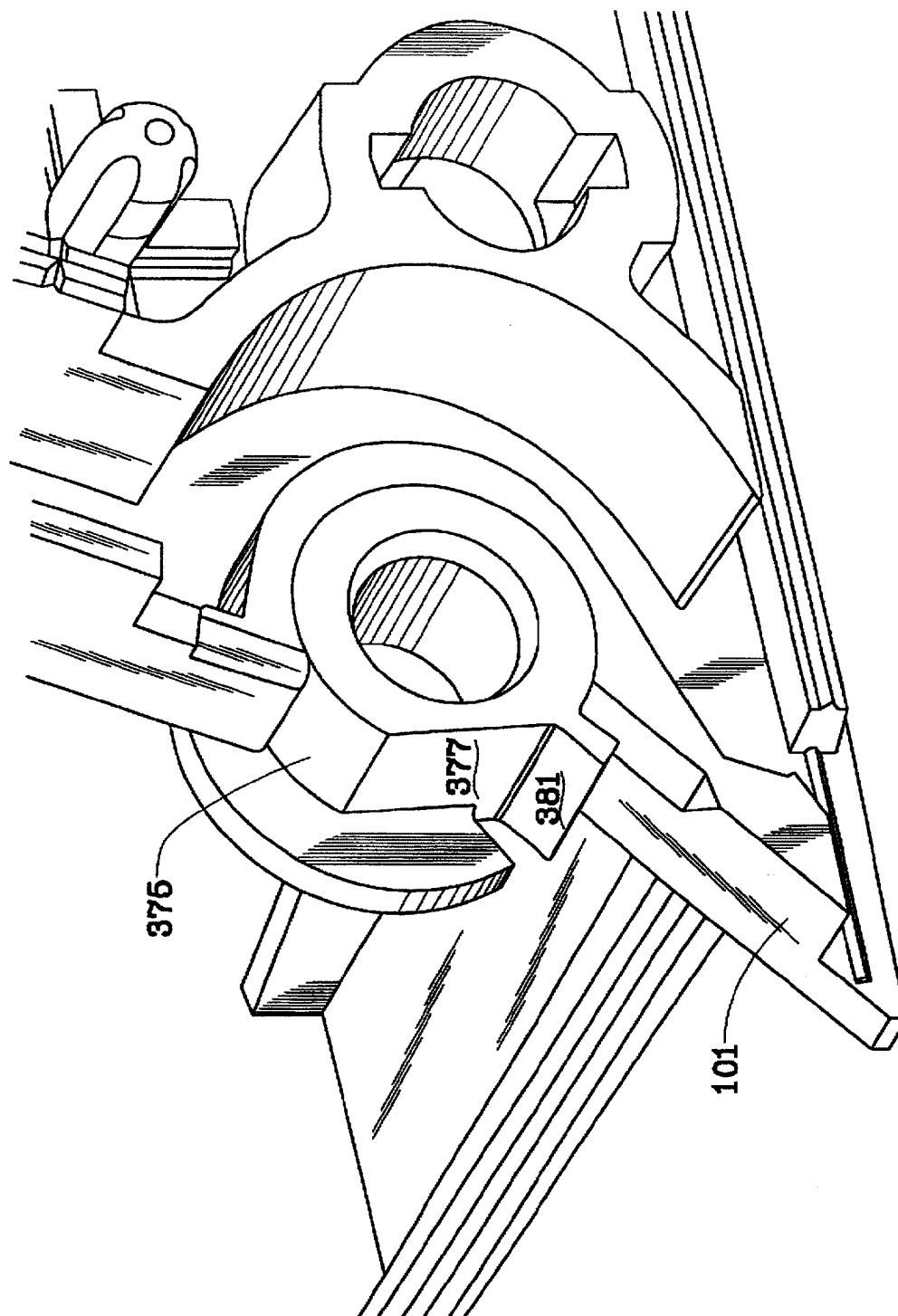
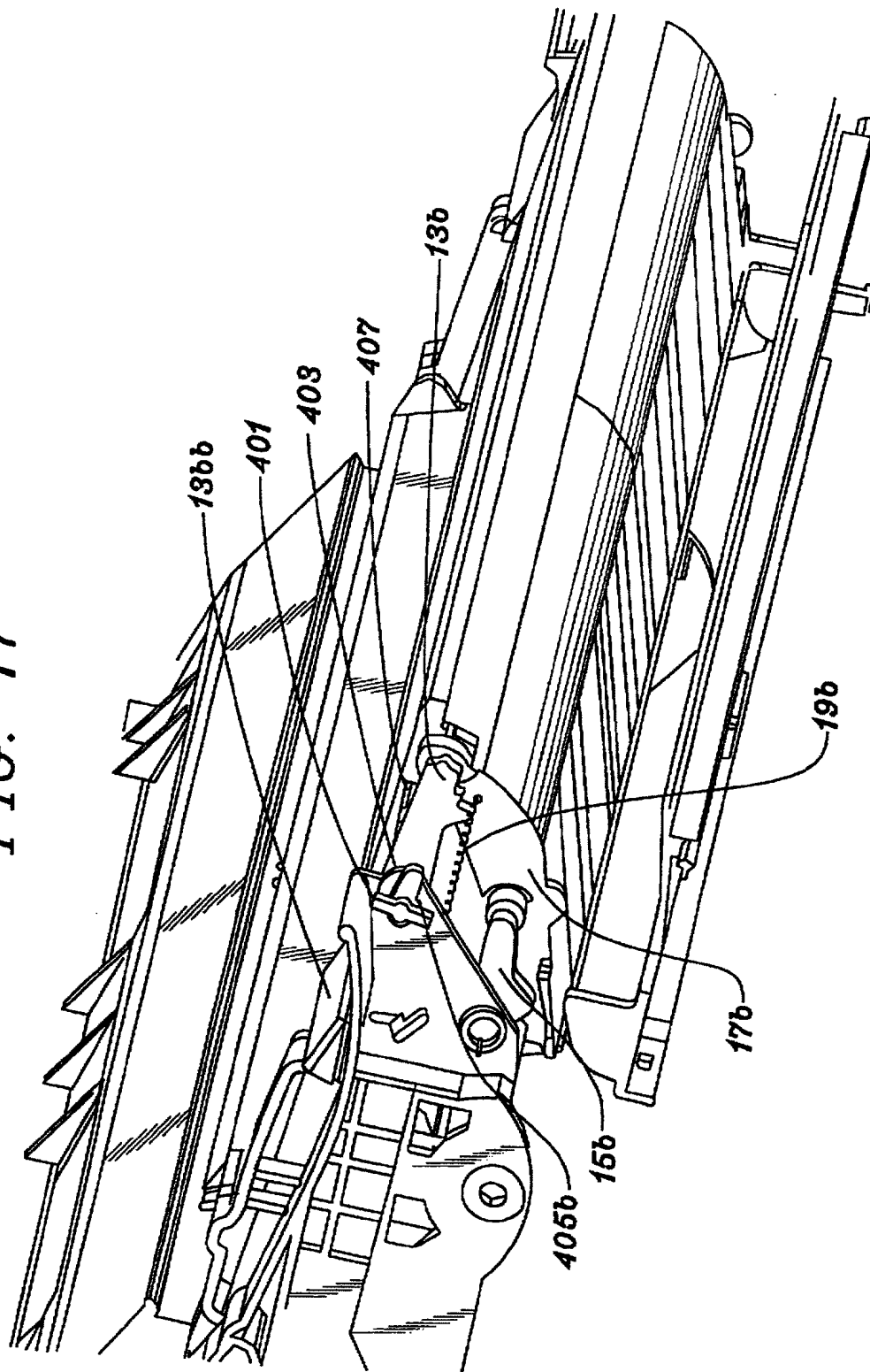


FIG. 17



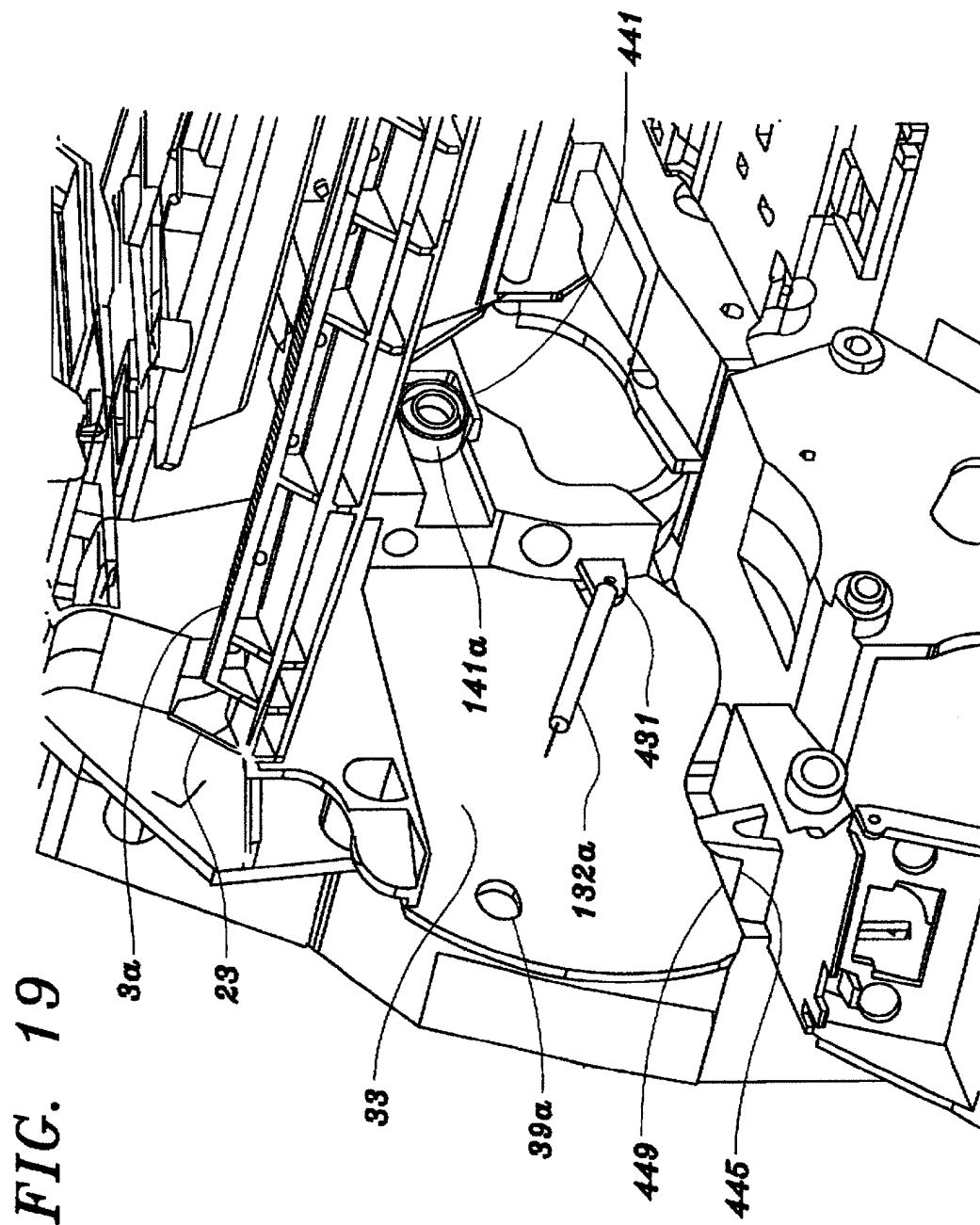




FIG. 20

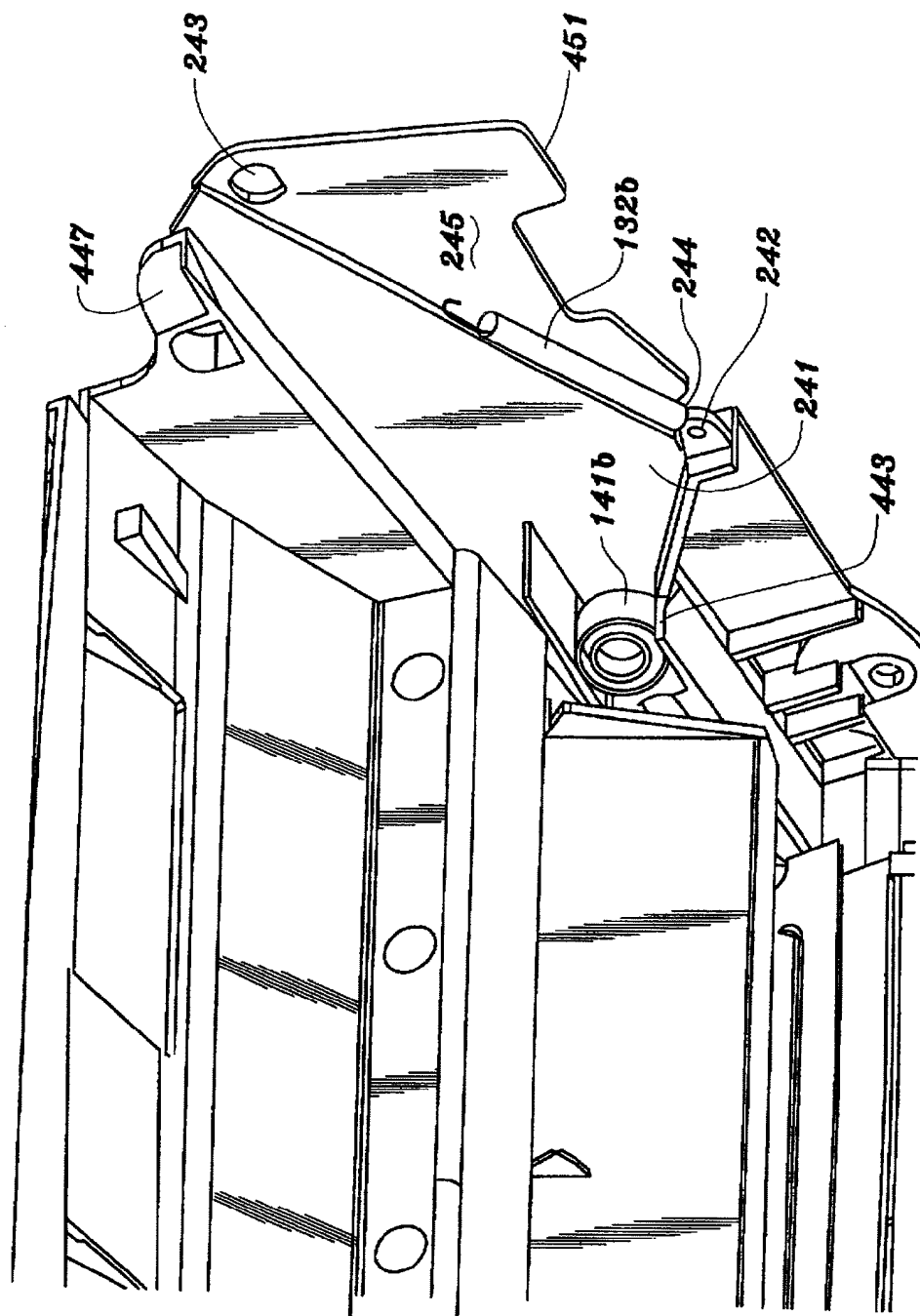


FIG. 21

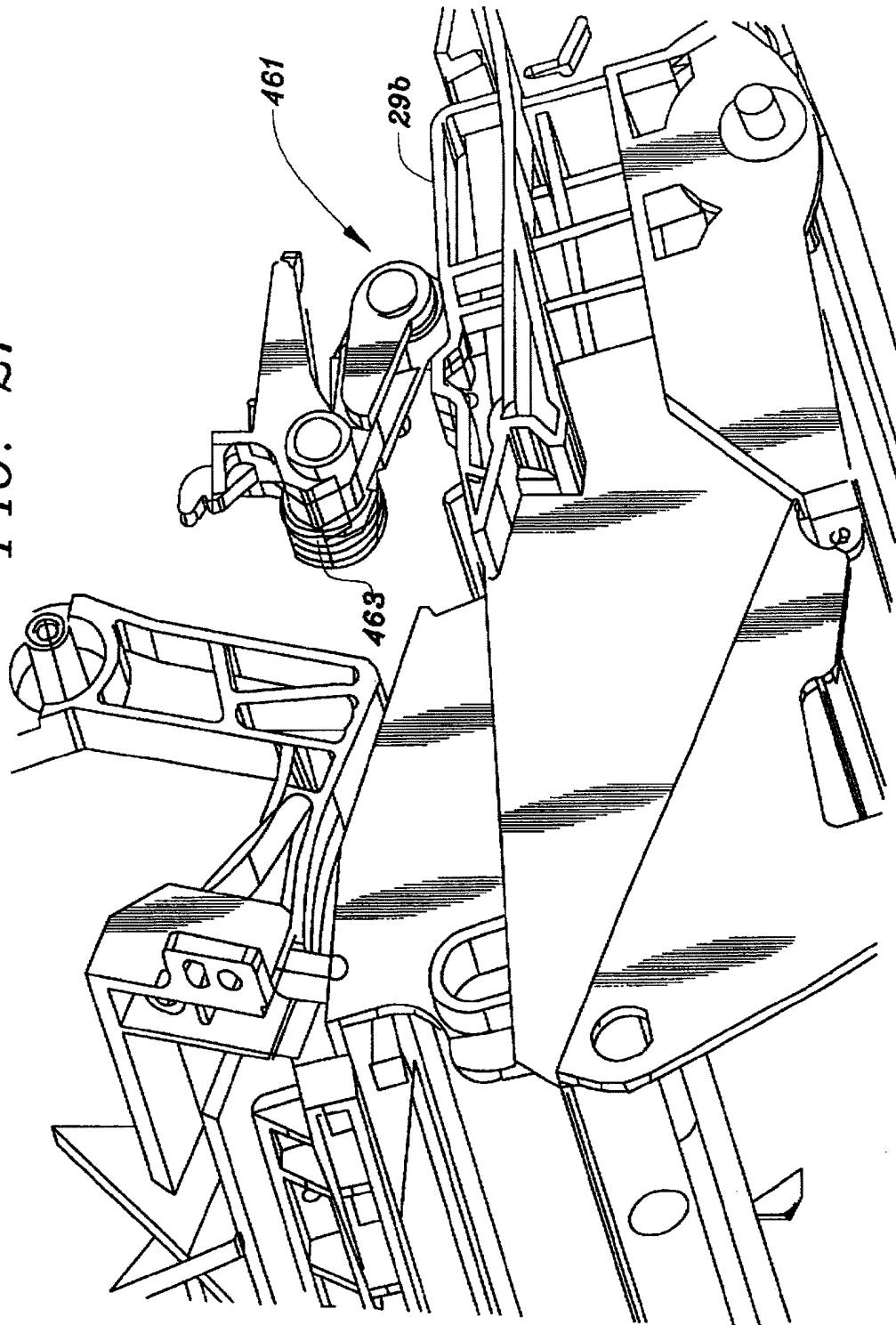


FIG. 22

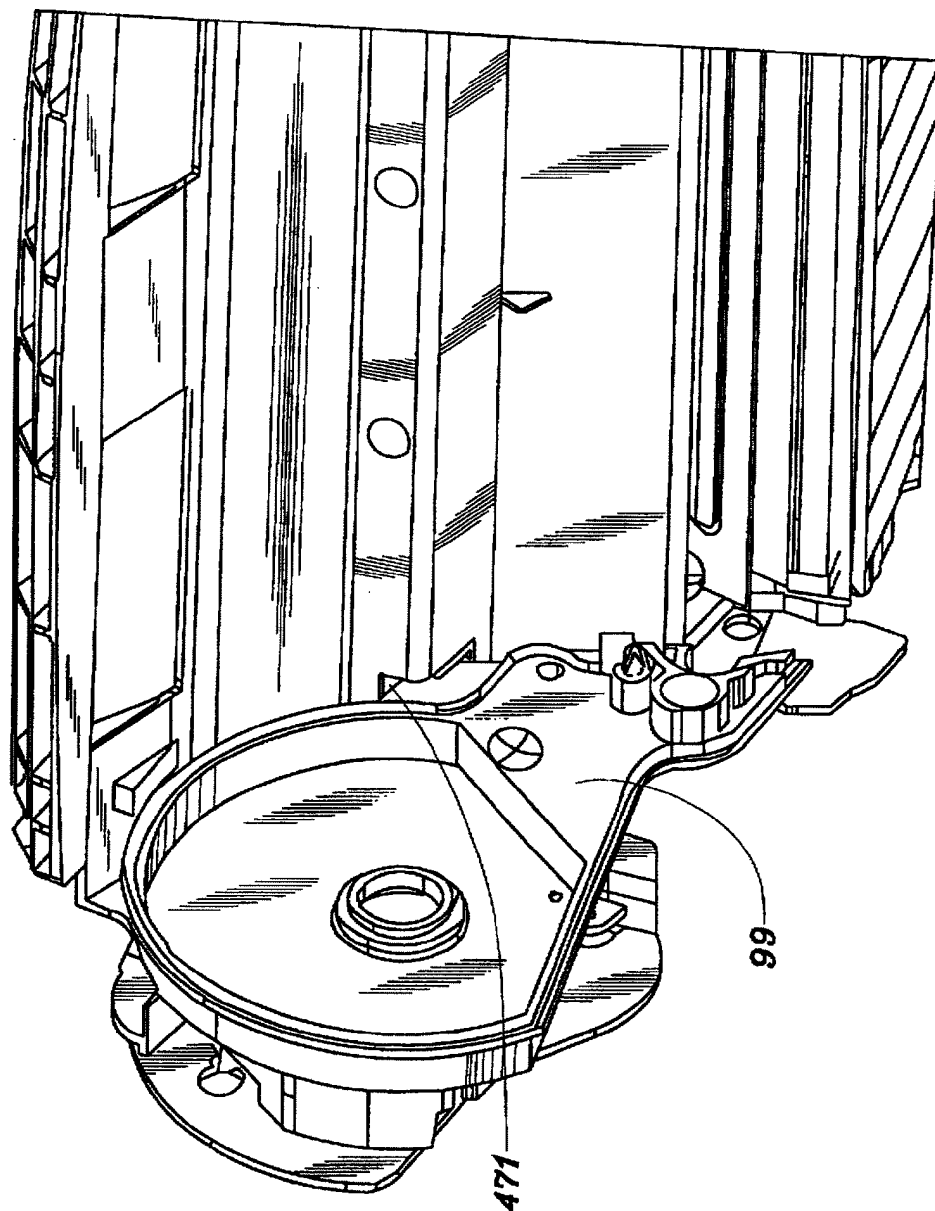


FIG. 23

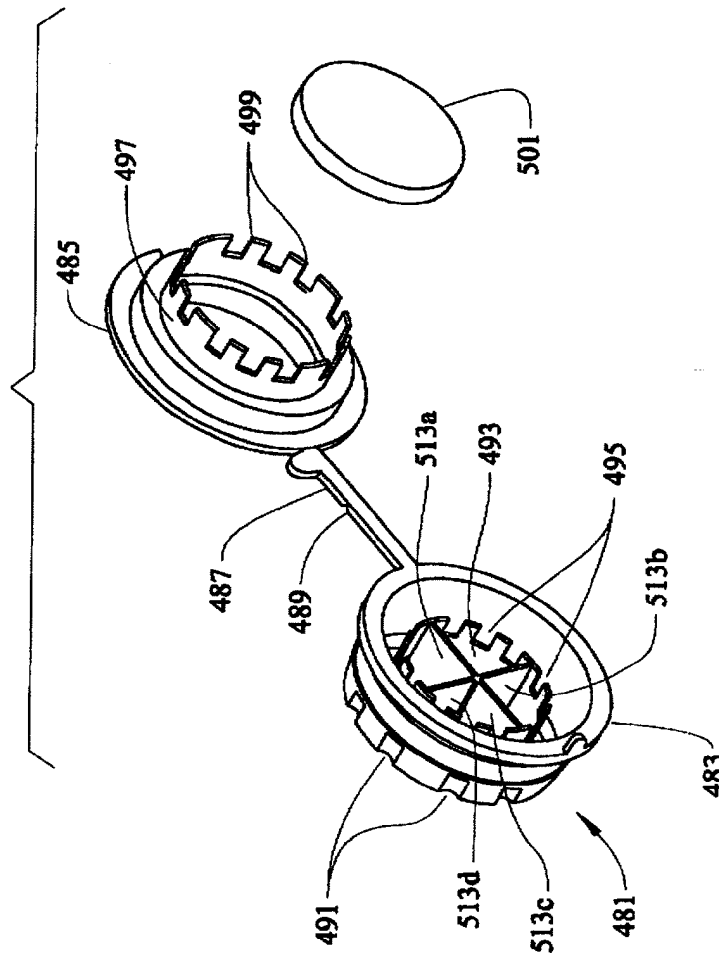


FIG. 24

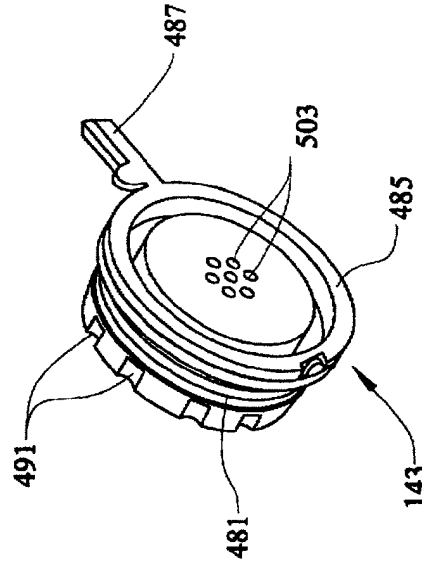
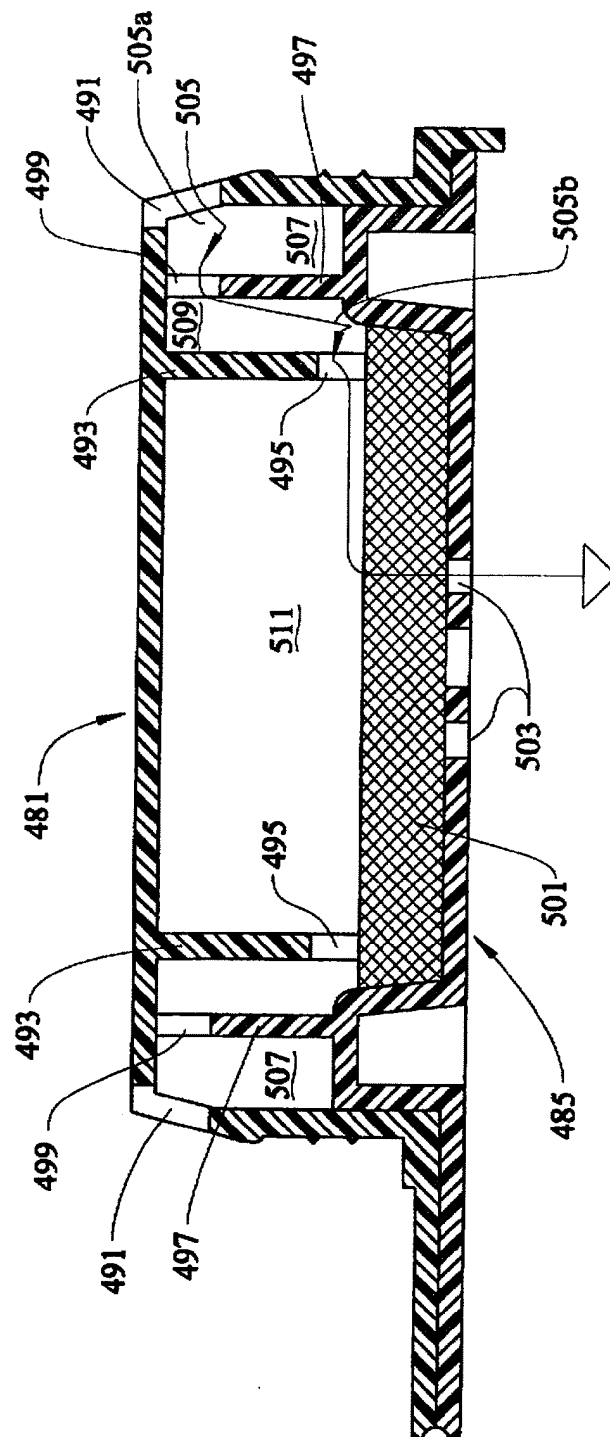


FIG. 25



## TONER CARTRIDGE WITH HOUSING AND PIN CONSTRUCTION

### CROSS-REFERENCE TO RELATED APPLICATIONS

The following United States patent applications are directed to subject matter disclosed or incorporated in the disclosure of this application Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169 entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device; five utility applications filed the same day as this application entitled "Toner Cartridge with External Planar Installation Guides," Ser. No. 08/770,327, "Toner Cartridge with Hopper Exit Agitator," Ser. No. 08/770,328; "Toner Cartridge with Locating on Photoconductor Shaft," Ser. No. 08/770,326, "Toner Cartridge with Heat Shield Shutter," Ser. No. 08/770,326; and "Venting Plug in Toner Cartridge," Ser. No. 08/770,326 and one ornamental design application filed the same day as this application entitled "Toner Cartridge for Laser Printer," Ser. No. 29/066,775

### TECHNICAL FIELD

This invention relates to electrophotographic development and, more particularly, relates to a toner cartridge having no toner pump and associated structure.

### BACKGROUND OF THE INVENTION

The assignee of this invention has manufactured and sold commercially toner cartridges of two different general designs. For its larger laser printers the cartridge has contained a pump to meter toner of the kind disclosed in U.S. Pat. Nos. 5,012,289 to Aldrich et al. and 5,101,237 to Molloy, while the external structure of the cartridge is as disclosed in U.S. Pat. No. 5,136,333 to Craft et al. Details of other elements in the cartridge have varied.

For a smaller, light emitting diode printer, the cartridge is as disclosed in U.S. Pat. No. 5,337,032 to Baker et al., which has a toner hopper extending well below a level having the toner adder roller and which has independent drive systems for the photoconductor roller and for the developer roller system as disclosed in U.S. Pat. No. 5,331,378 to Baker et al.

This invention employs a loose housing and pin connection between the photoconductor assembly and the hopper assembly.

Prior cartridges have had at least three wheels riding on tracks connecting the hopper assembly to the housing and photoconductor assembly. These wheels define a plane in which the two assemblies have to adjust the contact force between the developer roller in the hopper assembly and the photoconductor roller in the housing assembly. Having all of those wheels in the cartridge is detrimental in that they add to the positional variations of the developer unit with respect to the paper path. Also, during rough handling the forward wheels in the cartridge tend to break off under the weight of the toner.

In this invention only the two rear rollers are in the cartridge. Two rollers which correspond to two front wheels in the former cartridge are in the printer. The hopper in the cartridge have flat surfaces which receive these cartridges.

### DISCLOSURE OF THE INVENTION

The toner cartridge of this invention has a first or unitary element making up a handle, a cover and a cleaner chamber

and holding the photoconductor drum. Each of the two side walls has a housing which loosely receives a pin of a second, single element. The second single or unitary element holds a developer roller and has a toner hopper having two pins on each side, one of the pins fitting in each of the housings. The second pins connect the two single elements for yieldably pressing the developer roller against the photoconductor drum, as is generally conventional.

Since the hopper element is only loosely connected to the cover element, the hopper can adjust by movement with respect to the frame of a printer on which it is mounted. This is facilitated by the hopper having a flat ledge on each side for resting on rollers in the printer. The preferred design has central locating elements to receive pressure from the printer on the top, curved planar guide wing-like element on each side, a link to a lower shutter on each side above the wing-like guides which will be moved to open the shutter when the guides are inserted in the printer, the central shaft of the photoconductor is unobstructed to serve as a lower locator.

Since the under side of the developer unit is part of the media path, referencing the hopper assembly to the printer improves location accuracy of the media path. The cartridge is resistant to rough handling, while the corresponding wheels in the former cartridges tended to break. A minor advantage is that the cost of the wheels and their installation is eliminated from the cartridge.

### BRIEF DESCRIPTION OF THE DRAWINGS

The details of this invention will be described in connection with the accompanying drawing, in which

FIG. 1 is a perspective view of the toner cartridge from above and left rear, where left is determined facing the printer from its front side where cartridge insertion is made;

FIG. 2 is a perspective view from above and left front of the cartridge sectioned near the top;

FIG. 3 is a top right front view of the cartridge with further cover elements removed;

FIG. 4 is a top right rear view of the cartridge with cover elements removed;

FIG. 5 is a top left rear view of the cartridge with cover elements removed;

FIG. 6 is a top right rear view of the cartridge sectioned similarly to the sectioning of FIG. 2;

FIG. 7 is a bottom left front view of the cartridge;

FIG. 8 is a bottom right rear view of the cartridge;

FIG. 9 is a front right perspective view of the hopper housing member;

FIG. 10 is a left front view of the inside of a printer in which cartridge 1 is installed;

FIG. 11 is a partially sectioned right side view showing more detail of parts shown in FIG. 10 with the cartridge installed;

FIG. 12 is a perspective view showing the inside one end member of the hopper;

FIG. 13 is a perspective view showing the inside of the other end member of the hopper;

FIG. 14 is a perspective view of the gear plate;

FIG. 15 is a perspective view of a readily removable bushing;

FIG. 16 is a perspective view showing the removable bushing installed;

FIG. 17 is a right rear view showing detail of a shutter;



FIG. 18 is a perspective view of an extended hub inserted in the photoconductor drum;

FIG. 19 is a right perspective view showing elements inside the cover of the cartridge;

FIG. 20 is a left bottom perspective view showing elements inside the cover of the cartridge;

FIG. 21 is a right perspective view showing parts of the cartridge installed in a printer; and

FIG. 22 shows the inside of the cover of the cartridge where it receives an extension from the hopper;

FIG. 23 shows elements of the hopper plug prior to assembly;

FIG. 24 shows the assembled hopper plug alone; and

FIG. 25 shows a staggered cross section of the hopper plug to illustrate air flow.

### BEST MODE FOR CARRYING OUT THE INVENTION

The self-contained, removable printer cartridge 1 is shown in FIG. 1 in a perspective view from above and left rear (the hand grips 3a and 3b being considered the front and the side having the pivoted upper shutter 5 being the upper side).

For purposes of illustration, FIG. 1 shows the upper shutter 5 pivoted downward to its open position and lower shutter 7 pivoted rearward and upward to its open position. In actual operation, these positions are reached by interaction with the printer or other device in which cartridge 1 is installed as will be explained below.

To facilitate and guide insertion of cartridge 1 into the printer, cartridge 1 has a left guide wing 9a and a right guide wing 9b. Guide wings 9a and 9b are thin planes formed as arcs of a relatively large circle, except near the front, where the bottom 9aa is enlarged downward. Guide wings 9a and 9b are mirror images of each other except that, in this particular embodiment described, the left guide wing 9a is wider (extends further laterally) than the right guide wing 9b simply to accommodate the width provided by a particular printer in which the exemplary cartridge 1 is to be installed.

In the embodiment herein described, bottom shutter 7 is pivoted from left-rear cover 31a on a left top actuator link arm 11a and from rear cover (not shown) on a right top actuator link arm 11b, located on opposite sides of shutter 7. Each link arm 11a, and 11b is integral with an actuator 13a, and 13b, respectively, each of which has a rectangular actuator surface 13aa and 13bb, respectively, which extends over the respective guide wings 9a, 9b.

A pivoted lower shutter link 15a and a side of the lower shutter 17a, pivoted to lower shutter link 15a left top actuator link arm and upper actuator link 11a complete a conventional four bar linkage to provide rotation of shutter 7 in response to rotation of actuator 13a. The rear end of coil spring 19a connects to a lower hook 11aa in link arm 11a to bias shutter 7 closed when the cartridge is not inserted in a printer or other device. The front end of coil spring 19a connects to an upper hole 31aa under actuator 13a. A mirror image of these parts (see FIG. 3) exists on the opposite side, the corresponding part of which will be designated by the same number with "b" letters.

When cartridge 1 is installed in the printer, actuator surfaces 13aa and 13bb are pushed downward by the mating surfaces of the printer to the positions above wings 9a, 9b respectively, as shown in FIG. 1.

Cartridge 1 is inserted by a human operator grasping grips 3a, 3b through holes 3aa, 3bb and moving cartridge 1 in the

direction of shutter 5 and toward the rear of the printer (291, FIG. 10) in which it is being installed. A series of upwardly extending ribs 21 spaced along the width of cartridge 1 under grips 3a, 3b, except at holes 3aa and 3bb, provide strength while holes 3aa and 3bb provide room for the fingers of a person to grasp grips 3a, 3b. On the left side is a relatively wide, upwardly extending tab 23. In a preferred combination of the embodiment of the invention described herein and an exemplary printer the top of tab 23 interacts with a physical sensing switch in the printer to detect that a cartridge 1 has been installed.

Front cover 25, on which grips 3a, 3b, ribs 21 and tab 23 are integrally formed, is above a separated toner hopper, as will be described. The top cover of cleaner chamber 27 is rearward of shutter 5.

Immediately inside wings 9a and 9b are raised, elongated locator surfaces 29a, 29b to which pressure is applied by a printer to firmly position the toning mechanisms of cartridge 1 when cartridge 1 is installed. Locator surfaces 29a and 29b, wings 9a and 9b, as well as rear cover 31 under wing 9a, are formed integral with cleaner housing 27. Also integral with these elements is front cover 25, having grips 3a, 3b and an outer cover 33 on the left side and generally coextensive in length with the length of front cover 25. Cover 33 has a U-shaped housing 35 at its top. Housing 35 traps spacer stud 37a as will be explained and an assembly hole 39a near the upper front of cover 33 and a spring-holding hole 39b near the lower front of cover 33.

A coupler 41 receives a drive element from a printer which contains an Oldham coupler to rotatably drive the developer roller 43 (not shown in FIG. 1) and toner adder roller 45 (not shown in FIG. 1). To the rear of coupler 41 is the shaft 47 of photoconductor drum 49 (drum not shown in FIG. 1).

FIG. 2 is a perspective view from above and left front of cartridge 1 sectioned near the top to show internal elements. At the immediate front is a large, cylindrical toner hopper 61, having a paddle 63, which, during operation, is rotated clockwise as seen in FIG. 2. Paddle 63 has an outer toner moving bar 63a, which extends across the width of hopper 61 except for a far left section 63aa which is inset as will be explained. The rear wall 61a of hopper 61 when cartridge 1 is installed for operation in a printer terminates at about one-third of the total height of hopper 61 as a flat surface 61aa (specifically, hopper 61 has a 106 mm diameter and the distance vertically from the lowest point of hopper 61 to the horizontal plane coinciding with the highest point surface 61aa of rear wall 61a is 35.3 mm). The upper surface 61aa of rear wall 61a is thin and flat with a slight downward angle from hopper 61 to facilitate removal of the molded part from its mold. An extension 65a from an agitator bar 65 has a depending tab 65b (see FIG. 9) which rests on upper wall 61aa thereby positioning agitator bar 65 slightly above upper wall 61aa. Extension 65a extends past upper wall 61aa to a location at which bar 63a of paddle 63 encounters extension 65a as it rotates. The surface 61aaa opposite surface 61aa from which toner exits is flat and at approximately 50 degrees from vertical (best seen in FIG. 9) when cartridge 1 is installed for operation in a printer.

Vertical ribs 67 located immediately rearward of rear wall 61a are stiffeners for top wall 69 formed about one-third down from the top of hopper 61. The toner moving bar 63a of paddle 63 is closely adjacent to the sides of hopper 61 except where the top of rear wall 61a and the start of top wall 69 form an opening for toner to be delivered rearward from hopper 61 to the toning mechanisms of cartridge 1. This is best shown in FIG. 9.

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In FIG. 2, a small part of developer roller 43 to which coupler 41 is directly attached, is seen past ribs 67. Developer roller 43 is parallel to and in contact with photoconductor drum 49. Cleaner chamber 27 has spaced, vertical internal baffles 71, which are strengthening members, as well as members which limit unbalanced accumulation of toner in chamber 27. Toner which is not transferred during development is scraped from photoconductor drum 49 by cleaning blade 73, which is mounted to a vertical panel 73a, having a horizontal gusset 73aa to increase strength. As best seen in FIG. 3, panel 73a is mounted to supporting member 75, which has vertical columns 75a (FIG. 2), 75b on opposite sides. Panel 73a is mounted to the vertical columns 75a, 75b by a screw 77a to column 75a and a screw 77b to column 75b.

FIG. 3 is a top right side view with further cover elements removed and part of the cleaner removed to illustrate the internal configuration of cartridge 1. A solid, steel-bar doctor blade 91 extends parallel with and in pressure contact with developer roller 43. Blade 91 contacts roller 43 at about 20 degrees from the vertical toward toner adder roller 45. Also shown in FIG. 3 are metal electrical contact 93 to doctor blade 91, metal electrical contact 95 to toner adder roller 45 and metal electrical contact 97 to developer roller 43. The outer ends 93a, 95a, 97a of the contacts bear against metal contacts in the printer when cartridge 1 is installed and thereby make electrical contact to receive electrical potentials from the printer.

The developing system of cartridge 1 is essentially very similar to that of the Opra brand family of printers sold by the assignee of this invention. As in that family of printers, toner adder roller 45 is a conductive sponge material attached to a steel shaft and developer roller 43 is semiconductive material attached to a steel shaft. When cartridge 1 is installed for operation in a printer, cartridge 1 is oriented generally as shown in FIG. 3 and the horizontal plane containing the lowest surface of toner adder roller 45 is 22.6 mm above the lowest point of hopper 61.

Toner adder roller 45 and developer roller 43 are journaled in the rearward extensions 99a and 101a (FIG. 4) of the end members 99 and 101 (FIG. 4) of hopper 61. Agitator 65 has a bent portion 65aa to become parallel to extension 99a where it is pivoted to extension 99a on pin 103a. As paddle 63 rotates, bar 63a contacts extension 65a, thereby rotating agitator 65 around pin 103a upward. Agitator 65 then returns to near rear wall 61a under the force of gravity to dislodge toner, which otherwise tends to accumulate on exit surface 61aaa (see FIG. 9).

FIG. 4 is a top right rear view with cover elements removed showing more fully the end members 99 and 101 of hopper 61 and their extensions 99a and 101a. Integral with end member 101 is spacer stud 37b. Under and to the front of stud 37b is spring mounting post 131b, which mounts one end of spring 132b, the other end of which is mounted on hole 242 (best seen in FIG. 20).

Also integral with end member 101 is perpendicular shield wall 133, which extends downward and rearward to present a barrier to physically protect encoder wheel 135. The bottom portion of wall 133 forms a flat contact surface 133a to receive a locating roller from the printer when cartridge 1 is installed. Encoder wheel 135 is linked to paddle 63 through a paddle gear assembly 163 having a torsional yield member (FIG. 5) so as to provide information as to the amount of toner in hopper 61 to the printer on which cartridge 1 is installed by the sensing of the location of windows 135a. Additionally, other windows 135b provide

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other information, while wider window 135c provides a home location reference. Light blocking selected labels 136 are located between windows 135b and 135c and block windows of a series of windows 135b to thereby customize information onto wheel 135. The details and operation of encoder wheel 135 are described in U.S. patent application Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169, entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device" and form no contribution to the invention of this specification.

FIG. 4 also shows electrical contacts 93, 95 and 97 as they are supported by floor 137 which extends perpendicularly from hopper extension 101a. Vertical ribs 139 extend from floor 137 between contacts 93, 95 and 97 to strengthen the floor 137.

Mounting roller 141a is journaled to hopper extension 99a and symmetrical mounting roller 141b is mounted to hopper extension 101a. Rollers 141a and 141b contact inside surfaces of the cover of cartridge 1, as will be described. Surfaces 133a and 161a (FIG. 5) of hopper 61 rests on rollers in the printer as will be further described.

Hopper end member 101 has an opening receiving a closely-fitting, resilient, cylindrical plug 143. Prior to installing plug 143, toner is loaded into hopper 61 through the open hole, then plug 143 seals the hole.

Photoconductor roller 49 has at its right end a transfer roller drive gear 145, which drives a roller in the printer when cartridge 1 is installed in the printer.

FIG. 5 is a top left rear view with cover elements removed showing more fully the outside of members 99 and 99a of hopper 61. Integral with end member 99 is spacer stud 37a. Under and to the front of stud 37a is spring mounting post 131a, which mounts one end of spring 132a, the other end of which is mounted in a hole in member 431 (FIG. 19), which is an inner extension of cover 33 (FIG. 2).

Also integral with end member 99 is perpendicular shield wall 161, which extends downward and rearward to a barrier to physically protect torsional paddle gear assembly 163. The bottom portion of wall 161 forms a flat contact surface 161a to receive a locating roller from the printer when cartridge 1 is installed. The details of paddle gear assembly 163 are not part of this invention and are more fully disclosed in the above-mentioned patent application Ser. No. 08/602,648, now U.S. Pat. No. 5,634,169.

Gear 49a, integral with the end of photoconductor drum 49, receives power from a meshing gear in the printer when cartridge 1 is installed in the printer. Coupler 41 is integral with developer roller 43 and drives idler gear 165, which drives toner adder roller 45 (FIG. 3) by being meshed with gear 167, which is integral with toner adder roller 45. Coupler 41 receives power from a driver in the printer which is separate from the drive to drum 49, although preferably from a single motor in the printer.

Gear 167 drives the large gear of compound gear 169. Gear 169 drives the large gear of compound gear 171, and gear 171 drives paddle gear assembly 163. A gear plate 173, mounting gears 165 and 169, is mounted on hopper extension 99a by mounting screw 175.

FIG. 5 shows the end of agitator 65 opposite that shown in FIG. 3. That end has a bent portion 65bb to become parallel to extension 101a of end member 101a when it is pivoted to extension on a pin 103b.

Continuing the detailed description of the cartridge incorporating a preferred embodiment of the present invention,

FIG. 6 is a top right rear view sectioned near the top similar to the sectioning of FIG. 2. FIG. 6 illustrates more clearly the mounting of doctor blade 91 mounted to press on developer roller 43 under the bias of leaf spring 191. Blade 91 is located on the left rear by tab 361 (best seen in FIG. 14), and on the rear by extension 196a (FIG. 12) of hopper end member 99 which form front and back barriers for holding the left side of doctor blade 91. Similarly, on the right side, two surfaces extending from extension 101a, including a rear extension 365 (best seen in FIG. 13) and a front extension 366 (FIG. 13) form front and back holding the right side of doctor blade 91, symmetric to the cage holding the left side of doctor blade 91. The top of blade 91 is held by spring 191. An adhesive tape 192 across the top of the doctor blade 91 bridges over the adjoining horizontal edge of wall 69 (FIG. 2) for sealing, as is conventional.

Spring 191 has blunt ends 191a and 191b, spaced from the center, which contact blade 91 to bias it downward on to developer roller 43. A central ledge 197, integral with ribs 67, forms a cavity receiving the center of spring 191. Horizontal ledges 199a and 199b, opposite central parts of spring 191, formed integral with ribs 67, are horizontal barriers to prevent spring 191 from moving toward the front. Preferably, so as to permit rough handling of cartridge 1 which might occur during shipment, solid upper stop members (not shown) are attached by double sided adhesive on each side between ledges 199a and 199b and the sides 99a and 101a, respectively. These are spaced 0.18 mm above the top of blade 91 and, therefore, contact blade 91 only during rough handling.

FIG. 6 also illustrates posts 141aa and 141bb, which are molded as extensions of members 99a and 101a, respectively, and supporting mounting rollers 141a and 141b, respectively (FIG. 5).

FIG. 7 is a bottom left front depiction of cartridge 1 viewed externally. A series of horizontal depressions 221 along the back of hopper 61 provide a roughened surface for thumbs when fingers grasp the cartridge through opening 3aa and 3bb. A series of relatively long vertical ribs 223 integral with the bottom of hopper 61 serve as paper and other media guides, while a series of shorter ribs 225, located rearward of the start of ribs 223 and between ribs 223, prevent media snags as media encounter photoconductor drum 49, located immediately after ribs 223 and 225. Past drum 49, media encounter further media guide ribs 227 located on the bottom of shutter 7. FIG. 7 also affords a clear view of idler gear 165 and gear 167.

FIG. 8 is a bottom right rear depiction of cartridge 1 viewed externally. This shows the full right guide wing 9b with enlarged front part 9bb. FIG. 8 shows the right cover elements which were deleted in FIG. 6. A front lower cover section 241 is over much of the encoder wheel 135 and has an access hole 243 for ease of assembly and has an access opening 244 (best seen in FIG. 20). Cover section 241 is stepped outward a small amount to provide room for spring 132b (FIG. 20) to extend between post 131b (FIG. 4) and hole 242 (best seen in FIG. 20). Generally, above and forward of and integral with cover section 241 is cover section 245, which is over the remaining upper front of cartridge 1. Section 245 has a U-shaped housing 247 at its top which traps spacer stud 37b. In the rearward part of section 245 opposite the area above photoconductor drum 49, are located rectangular channels 249 with the second rectangular channel 249a and the last rectangular channel 249b being open to pass air for cooling photoconductor drum 49 during operation of cartridge 1.

The far rear portion 251 of this particular embodiment of the invention herein described mounts links 11b and 17b to

shutter 7. A bottom section 253 of the cover located under and forward of passages 249a and 249b mounts the shaft 47 of photoconductor drum 49 and has two upper symmetrical vent holes 255a and 255b to pass air for cooling drum 49.

FIG. 9 is a front right perspective view of the molded plastic member housing 271 which forms the central portion and central extension of hopper 61 with end member 99 attached and agitator 65 installed. It is seen to form a cylindrical chamber with an exit opening formed between wall 69 and wall 61a. An inset 273 at the bottom rear of hopper 61 provides space for rollers in the printer. As best seen in FIG. 2, paddle bar 63a has an inset for left section 63aa to clear inset 273.

Member 271 has a slot 275 around its right side. A directly similar slot is around the left side. End member 101 has a mating ridge 321 (FIG. 13). During manufacture slot 275 is mated with ridge 321 in end member 101 and the two are welded together with ultrasonically created heat. Member 99 is welded to the left side of member 271 in the same manner with ridge 322 (FIG. 12) inserted in a mating slot (not shown) on the left side of member 271.

A notch 277 above agitator extension 65a allows for sufficient rotation of agitator 65 to allow paddle arm 63a to pass beyond extension 65a while preventing a full turn-over of agitator 65.

#### Developer Assembly

The housing 271 and its attached end members 99 and 101, form toner hopper 61. Extension 101a journals toner adder roller 45 and developer roller 43. Gear plate 173, which is attached to extension 99a by screw 175, journals the opposite ends of toner adder roller 45 and developer roller 43. Accordingly, a single unitary assembly is formed of the hopper 61 rearward to and including developer roller 43.

#### Photoconductor and Cover Assembly

Front cover 25 grips 3a, 3b, left outer cover 33, rear wall 31, (FIG. 1) right cover sections 241, 245, and 251, (FIG. 8) wings 9a, 9b and cleaning chamber 27 are a single molded part. Photoconductor 49 is journaled in this part with its shaft 47 extending past the covers on opposite sides. Shutter 7 is movably supported to left cover 31 and right rear cover 251. Accordingly, a single unitary assembly is formed of the cover members, the photoconductor drum 49 and the shutter 7.

In use, springs 132a and 132b pull the developer roller 43 against the photoconductor drum 49 at a predetermined tension. When cartridge 1 is picked up, the developer assembly and the photoconductor and cover assembly rotate under gravity until stud 37a (FIG. 1) contacts housing 35 and stud 37b (FIG. 8) contacts housing 247, thereby holding the two assemblies together.

#### Lower Shutter as Heat Barrier

Lower shutter 7, when open, covers all of the lower surface of the cleaner chamber. The material of shutter 7 is polycarbonate, a material which deflects heat from the fixing operation which occurs after paper is moved rearward from contact with the photoconductive drum 49. The material of the body of the photoconductor and cover assembly, the hopper 61, end members 99 and 101, and shutter 5 are polystyrene which is lower in cost than polycarbonate would be. The added cost of shutter 7 being polycarbonate is justified by shutter 7 providing heat protection to the cleaner 27 which allows that member to be polystyrene.



## Agitator Bar System

The toner of cartridge 1 is monocomponent, which can become stagnant and cohesive when left undisturbed for a time. This stagnation and settling of toner may be aggravated by the slight vibrations generated by the printer motor and gear train in a laser printer.

Failure to deliver toner from wall 61a via sloped exit surface 61aaa is the consequence of the settling, stagnation, and cohesive nature of the monocomponent toner in hopper 61. The angle of repose of the settled toner (i.e., the angle of tilt of a surface on which the settled toner rests before it "falls" under its own weight) can reach or exceed 90 degrees. The exiting surface 61aaa is tilted upward at approximately 50 degrees from vertical during operation (angle A, FIG. 9), allowing the toner to stagnate into a pile that does not reach the toner adder roller 45. This leads to premature failure to print, termed "starvation," as would result using an empty cartridge. Experimentally, as much as 230 grams of the 465 gram capacity of hopper 61 of toner have been found in the hopper 61 of a cartridge 1 when starvation has occurred due to existence of a stagnant pile of toner preventing toner delivery to toner adder roller 45.

Agitator bar 65 overcomes toner stagnation and failure to deliver toner to toner adder roller 45. The primary function of agitator bar 65 is to prevent toner stagnation and to deliver toner from the entrance of the developer sump to the toner adder roller thus preventing premature failure to print.

As the hopper paddle 63 rotates counter-clockwise (FIG. 3), it reaches a point in its rotation where it begins to contact extension 65a and lift agitator bar 65. Paddle 63 continues to lift agitator bar 65 until it loses engagement with extension 65a. At this point, the agitator bar 65 falls back via gravity to the resting position, carrying toner from the entry of the developer chamber to the toner adder roller. (Although not useful on the disclosed embodiment, an alternative is a pad on extension 65a or on upper wall 61aa which will cushion the fall. Such a pad would also serve as a spacer to control the position of the agitator in the down position and eliminate tab 65b).

At the top of its travel the agitator bar 65 is out of the way of the main sump paddle 63 and approaches a notch 277 in the hopper housing 271 (FIG. 9). Notch 277 provides space for the agitator bar 65 to clear the end of hopper paddle 63, and prevents overtravel of the agitator arm 65, which could cause locking into an up position when the cartridge is shipped, stored, or handled outside of the machine.

In the up position, the agitator bar 65 forms a nearly vertical wall over hopper wall 61a. The initial opening above wall 61a is about 26.7 mm, while the height of bar 65 facing that opening is 7 mm. This allows room for toner from the main sump to flow between the agitator 65 and sloped wall 61aaa. It also serves as a temporary barrier to prevent the delivery of excessive amounts of toner from the hopper 61 to the toner adder roller 45. As the agitator bar 65 falls to its resting position, both newly delivered toner and any stagnant toner resting on wall 61aaa are pushed toward the toner adder roll 45. The motion of the agitator 65 also stirs toner in the area above and toward developer roll to doctor blade nip 91, helping to prevent packing and stagnation of toner in this volume.

The agitator 65, preferably can be implemented by stamping (or laser cutting) and can be formed from sheet metal with spring characteristics that maintain agitator shape during assembly and operation. The entire part comprising bar 65, extension 65a and bent portions 65aa and 65bb preferably can be made by stamping out all features in one

operation. As envisioned for the preferred embodiment, illustrated herein, bar 65 may have a length approximately equal to the toner adder roller length, which may be, for example, 220 mm; and have an exemplary height of approximately 7 mm; a thickness of 1.3 mm, chosen to give an agitator mass of the entire part stamped of, for example, approximately 20 grams. Since agitator bar 65 is driven by gravity, the mass is chosen to provide a driving force sufficient to push stagnant toner along wall 61aaa to toner adding roll 45, but the mass is limited so as not to affect the torque sensing function of the hopper paddle 63.

Hinge segments 65aa and 65bb and the associated distance from pins 103a and 103b to agitator bar 65 determine the arc swept by bar 65 as it falls from the up position to the down position. In the present preferred embodiment, pivot distance of 13.5 mm, for example, allows the paddle to sweep from an up position which leaves a gap of 3 mm between the bottom of the bar 65 and the wall 61aa, to a down position 3 mm above the toner adder roller 45. With this design, the weight of the paddle is effectively applied to move toner over the distance swept by the arc. A shorter pivot distance would result in insufficient travel to capture and deliver toner; and would require a heavier paddle to exert the same force on the toner over the distance swept through the arc. Pins 103a and 103b are smaller in diameter (1 mm, for example) than their holes in which they fit in portions 65aa and 65bb to prevent binding due to toner buildup.

Extension 65a is long enough to engage the active segment of paddle 63. Additionally, the length of extension 65a is long enough to overlap the active segment of paddle 63 when extension 65a first engages the paddle 63 to prevent scraping of the paddle surface. A small radius (0.5 mm, for example) is placed on the bottom tip of extension 65a to prevent scraping of paddle 63 as it releases extension 65a.

The overall length and elasticity of the agitator 65 allows assembly over pins 103a and 103b by simply deflecting the part.

Accordingly, this agitator design functions to overcome toner stagnation and to deliver toner from the entry of the hopper 61 to the toner adder roller 45 active area. The agitator 65 and its extensions 65a, 65aa and 65bb are a single part. Agitator bar 65 is driven internally, with no external gearing, cams, or seals as would be required by an externally driven agitator. Thus gear cost and complexity, seals, friction, and toner leaks are eliminated as problem areas. Agitator 65 is activated frequently enough to move toner and prevent stagnation without adding excessive stirring or damage to the toner. This design enhances first-in, first-out toner delivery from hopper 61 to the smaller area containing the toner adder roller 45 by preventing excessive toner delivery in the raised position and discouraging return toner from the area of the toner adder roller 45 to the hopper 61.

## Dimensions

With the cartridge installed for operation, the location of the nip of toner adder roller 45 with developer roller 43 is at 105 degrees from vertical. The nip angle of the photoconductor drum 49 to the developer roller 43 is 95 degrees from vertical. As previously stated, the doctor blade nip is at 20 degrees from the vertical.

The length from the bottom of hopper 61 to the horizontal plane coinciding with the edge of top surface 69 near hopper 61 is 61.96 mm, creating an initial opening of about 26.7mm (as indicated previously, bottom surface 61aa is at 35.3

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mm). Top surface 69 has a slight upward angle to a tallest point of 64.34 mm.

The diameter of toner adder roller 45 is 14 mm and it is located with its circumference 1 mm above the bottom of hopper body 271 immediately below it. The diameter of developer roller 43 is 20.11 mm and it is located with its circumference 2 mm above the bottom of hopper body 271 immediately below it. The length from the bottom of hopper 61 to the horizontal plane coinciding with the bottom of developer roller 43 is 23.7 mm, and the corresponding length to the bottom of the toner adder roller 45 is 22.6 mm. The diameter of photoconductor drum 49 is 30 mm.

The bottom of body 271 under rollers 43 and 45 is at a 6 degree upward angle to provide sufficient room for guide ribs 225 on the outside of body 271.

#### Installing the Cartridge

FIG. 10 is a left front view of the inside of a printer with which the inventive cartridge herein described by way of an exemplary preferred embodiment may be used. The cartridge 1 is installed in a printer 291 (FIG. 10) from the front to a final position well within the printer 291. To achieve this, guide wings 9a and 9b are initially guided by a lower track 293 over a curved track, which guides cartridge 1 under the laser printhead (not shown) and over paper feed elements 295.

The path is downward, which utilizes gravity while inserting cartridge 1, thereby easing insertion. The guide 293 (and a guide not shown, which is a mirror image of guide 293 on the opposite side of printer 291) has the same curvature as wings 9a, 9b so that the wings 9a, 9b can follow guide 293 and its opposite guide.

Upper guide 297 is parallel to guide 293. Guide 297 extends further into the printer than guide 293. A guide (not shown), which is a mirror image of guide 297, is on the opposite side of printer 291. Guide 297 encounters actuator surface 13bb early during the insertion of cartridge 1. As cartridge 1 is moved rearward, actuator surface 13bb is rotated to open shutter 7 (as is surface 13aa rotated by encountering a mirror image of guide 297 on the left side of the printer). This early movement of shutter 7 is very advantageous in that it eliminates the need for space and mechanism which would be required if actuation occurred at the end of insertion of cartridge 1.

Also shown in FIG. 10 is the right reference position roller 299 on which contact surface 133a rests when the cartridge is inserted. Contact surface 161a will rest on an identical roller (not shown) on the opposite side of printer 291. Rearward of roller 299 is V-block 301, shown more clearly in FIG. 11, and an associated electrical contact 302. Further rearward is an upstanding lug 303, which will contact shutter 7 to hold it open as will be described.

As cartridge 1 is inserted, wings 9a, 9b are guided by guides 293 and 297 and the mirror image guide (not shown) on the opposite side of printer 291. As insertion continues, the wings 9a, 9b fall off the lower guide 293 (and its mirror image guide) and the shaft 47 of photoconductor drum 49 drops into V-block 301 and a mirror image V-block (not shown) on the opposite side of printer 291. A depending thin metal sheet 302 (FIG. 11, shown in side view) is contacted and bent somewhat by shaft 47 as it is guided by V-block 301. This creates a connection for operating potential to shaft 47. When cartridge 1 falls into V-block 301, lug 303 contacts shutter 7 to hold shutter 7 open. Prior to that the longer length of upper guide 297 was sufficient to hold shutter 7 open.

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In this final position cartridge 1 is more precisely located with respect to functional elements. Cartridge 1 is held in printer 291 as described below under the heading "Reference Surfaces."

To remove the cartridge, it is grasped by grips 3a, 3b and pulled sharply upward and forward. Wings 9a and 9b again enter between guides 293 and 297, and the cartridge can be pulled free.

#### Manufacture of Cartridge

All molded parts follow the technical dictate (to avoid distortion on cooling) of keeping adjoining surfaces the same thickness. Accordingly, molded studs seen from the rear (shown, for example, in FIG. 13) appear as holes in the part. Circles in the drawings with bowed lines crossing indicate the gate where molten resin was received into the mold (shown, for example, also in FIG. 13).

Assembly of cartridge 1 begins with the joining of hopper body 271 to its end members 99 and 101 with paddle 63 installed. The inside of end member 99 is shown in FIG. 12 and the inside of member 101 is shown in FIG. 13. Both are molded parts of polystyrene resin. Each of the members 99 and 101 is mated to its corresponding side of body 271 (FIG. 9). Ridge 321 of member 101 enters slot 275 on the right edge of member 271. Ridge 322 of member 99 enters slot (not shown) on the left edge of member 271 mating ridge 322. Those parts are held tightly in a fixture and ultrasonically welded, with paddle 63 inserted before the last of the two end members is welded. Then a bushing (not shown) is press fit into the central hole 325 of member 101 around the shaft of paddle 63 and a second bushing (not shown) is similarly press fit around the shaft of paddle 63 in central hole 329.

Agitator bar 65 (FIG. 9) is then flexed and installed by mounting end portion 65aa on pin 103a and end portion 65bb on pin 103b.

Toner adder roller 45 with low friction washers on each end is then installed by angling its shaft through hole 333 (FIG. 12) in member 99, straightening, and then moving roller 45 laterally to bring its shaft through a press fit bushing (not shown) in socket 335 in member 101.

Prior to installing toner adder roller 45 and gear plate 173, a sickle-shaped seal member having a semicircular central body (not shown) is installed on each side of the location of developer roller 43. Such a seal is illustrated in IBM Technical Disclosure Bulletin, Vol. 33, No. 3B, August 1990, pp. 29-30, entitled "Toner Seal for Printer." The location of this seal on the right side is labeled surface 383 in FIG. 13. This is essentially standard as putty is first applied on each end of the location for the seal and the ends of the compliant elongated seal are pressed into the putty. The seal has ridges directed slightly toward the center. A seal system such as this is essentially the same as previous cartridges.

Doctor blade 91 (best seen in FIG. 6) is then installed by bringing it vertically upward behind ridge 365 (FIG. 13) on the right. In the completed cartridge 1 blade 91 is held on the bottom by contact with developer roller 43. Developer roller 43 with low friction washers on each end is installed by positioning the left end of its shaft past end member 99 (FIG. 12) and threading the right end of its shaft through the central hole the bushing 375, shown in FIG. 15.

Gear plate 173 is shown alone in FIG. 14. It has a hole 351 to receive of the shaft of toner adder roller 45 and hole 359 for shaft of developer roller 43. A central hole 353 is to receive screw 175 but hole 353 is significantly larger than

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the shaft of screw 175. Gear plate 173 has a shaft 355, a shaft 357, and a rightwardly extending tab 361.

Gear plate 173 is brought toward member 99 while the shafts of toner adder roller 45 and developer roller 43 are positioned through holes 351 and hole 359 respectively. Gear plate 173 is rotated until tab 361 abuts the edge of doctor blade 91. This serves as a locator for gear plate 173 and doctor blade 91. Screw 175 is then tightened in hole 353 to fix plate 173 in that position.

Gears 169, 165 and 171 are pressed on shafts 355, 357 and 363 (FIG. 5, on member 99). (As is shown in FIG. 14, such shafts have an enlarged head with a gap so as to be yieldable when receiving a press-on force.) A gear 191 is also pressed on the shaft toner adder roller 45. Paddle gear assembly 163 is pressed onto the shaft of paddle 63. These gears and drive coupler 41 are keyed to their shafts by the two having matching "D" cross sections.

Bushing 375 has a flat outside segment 377 which permits bushing 375 to enter opening 379 (FIG. 13) in member 101 since opening 379 is circular with an open less-than-one-half circle segment in which bushing 375 can fit at one orientation. Bushing 375 is then rotated in a direction to rotate lower tab 381 downward, which removes the orientation at which bushing 375 can fit through the incomplete segment of 379 and locks bushing 375 into place. Bushing 375 installed is shown in FIG. 16. In operation, developer roller 43 rotates in a direction to rotate tab 381 downward. The advantage of bushing 375 is that it provides for relatively easy installation and change of developer roller 43 in the event that a member requires replacement during subsequent tests.

Drive coupler 41 is then press fit on the left end of the shaft of developer roller 43 using a locating shim to space coupler 41 slightly from cover 31. Mounting rollers 141a and 141b are previously applied by press fit during completion of the hopper 61. An adhesive tape is applied across the top of doctor blade 91. Spring 191 is then flexed into place to bias doctor blade 91 downward. After toner is installed and leak tested, the previously mentioned upper stop members on each side of ledges 199a and 199b are applied individually and remain in place, held by their back adhesive layer. Also encoder wheel 135 is installed by press fit.

With rollers 43 and 45 and doctor blade 91 in place, metal contact 93 is inserted between ribs 139. Contact 93 has arrowhead sides to bind into ribs 139, and extends upward and over two posts 385 (FIG. 4) in member 101a and extends to a bent end which presses against doctor blade 91. Contacts 95 and 97 similarly have arrowhead sides which dig into ribs 139 and terminate in short bent ends 387, 389, respectively, which press against the shafts of roller 45 and 43, respectively. Contact grease is added to contacts and shafts.

The foregoing all are part of the developer assembly. The photoconductor and cover assembly is separately assembled. The cleaner blade panel 73a (see FIG. 3) is installed using screws 77a and 77b. Link arms 11a, 11b, 17a, 17b and 15a, 15b are assembled in a known manner by studs having extensions which enter matching holes in adjoining arms. The arms are then rotated to operating positions in which the extensions find no opening and therefore lock the members together while leaving them free to rotate. Links 13a to 11a and 13b to 11b are held by a pin 401 with latch, as shown in FIG. 17.

Pin 401 has a circular flexible arm 403 and arms 11a and 11b have a matching ledge 405b (the ledge on the opposite side not shown). Pin 401 is inserted through the holes of

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member 13a and 11a and another pin 401 is inserted through the holes of members 13b and 11b. The pins 401 are then rotated until their arms 403 flex around ledge 405b and the ledge on the opposite side, respectively, and then recover to latch under ledge 405b and the ledge on the opposite side, respectively. This holds both four bar linkages in place. Pin 401 has a shaft 407 (best seen in FIG. 4), which extends into a groove (not shown) on each side of cleaner 27 for added stability of each four bar linkage.

Shutter 7 is installed by flexing shutter 7 and locating pins 431b and a pin on the opposite side (not shown) on opposite sides and inserting pin 431b and the pin on the opposite side in holes in the sides of locator surface 29a, 29b, respectively. Pin 431b has a coil compression spring 433 wrapped around it which is tensioned to bias cover 7 upward.

As best seen in FIG. 19, one end of spring 132a is attached through a hole of connector tab 431 of cover 33 on one side and the opposite end of spring 132a is temporarily attached to hole 39a of cover 33. As seen in FIG. 20, spring 132b is attached through a hole of connector tab 242 of cover 241 on one side and the opposite end of spring 132b is temporarily attached to hole 243 of cover 241.

The photoconductor drum 49 is installed into the cleaner housing assembly by placing the drum and the two gears 49a and 145 (see FIGS. 4 and 5) in position with a thin washer, (not shown) on the left side and inserting shaft 47 through that assembly and the housings 31 (FIG. 2) and 253 (FIG. 8). Standard E-clips are installed on each end of shaft 47 to hold the drum and shaft from lateral movement. As shown in FIG. 18, an extending hub 145a of gear 145, has an internal copper sheet 421 with three sharp points 421a. Copper sheet 421 also has an elongated member 421b extending to over the central hole. Hub 145a is inserted inside drum 49. Points 421a dig into the aluminum cylinder which forms the inside of drum 49, creating both physical and electrical connection. Shaft 47 is then threaded through gear 145, drum 49 and then through gear 49a. This bends elongated member 421b so that it presses against shaft 47 and makes electrical contact.

The developer assembly is then placed before the photoconductor and cover assembly and the two are moved together. Covers 33 and 241, 245 flex outward and then close into the final position. Springs 132a and 132b are removed from holes 39a and 243 and manually attached to studs 131a and 131b respectively. This completes the cartridge 1.

It will be readily understood that any joint where toner is contained must be sealed. Immediately inside the bearings of toner paddle 63 and toner adder roller 45 synthetic rubber end seals are located. FIG. 13 shows a socket 335 having upper and lower tabs which receive such a seal, the seal having matching extensions which fit in the tabs to prevent rotation of the seal. The ends of the chamber of cleaner 27 have foam walls with outer adhesive to secure their positioning. As is previously known, other extended joints have a plastic (polyethylene terephthalate) tape with one side carrying pressure sensitive adhesive applied along them by the adhesive. As is also previously known, developer roller 43 is sealed with a tape which is cantilevered up from the bottom of body 271 to be located in front of the roller 43. A second adhesive strip seals the far rear edge of body 271. Such sealing is basically standard and forms no part of this invention.

#### Toner

In a preferred embodiment cartridge 1 employs mono-component electrophotographic toner which may be basically conventional. The amount of toner in hopper 61 is



limited by pressure impairing print quality and sensing of toner level by toner resistance on paddle 63. When cartridge 1 is in the installed position, a typical top level of toner will be 10 mm above the upper barrier wall 61a. The presence of toner at that typical highest level is indicated in FIG. 9 by surface lines of toner 425, but the toner is shown otherwise as transparent for clarity. The actual toner is, of course, an opaque, dry powder. During use, the toner is depleted to lower levels and it is moved by paddle 63. As is conventional, developer roller 43 applies toner 425 to photoconductor drum 49 to develop electrostatic images on photoconductor drum 49.

#### Reference Surfaces

FIG. 19 shows just the roller 141a of the hopper assembly as finally installed and, therefore, located on a flat surface 441 which is an extension of the cover 33. Similarly, FIG. 20 shows just the roller 141b of the hopper assembly as finally installed and therefore located on a flat surface 443 which is an extension of cover 241. Such positioning of an assembly with the photoconductor roller and an assembly with the developer roller for lateral adjustment for rollers is essentially the same as in prior cartridges.

However, in the described embodiment of the present cartridge, cartridge 1 has flat surfaces 133a and 161a and the printer 291 has the second set of rollers (roller 299, FIG. 10 and its mirror image), on which flat surfaces 133a and 161a, respectively, rest. In the prior cartridges a second set of rollers was part of the cartridge. As in the prior cartridges the two sets of rollers 141a, 141b, 299, and the mirror roller image of 299, define a plane of movement to guide the developer roller 43 into the intended contact with photoconductor drum 49.

FIG. 19 shows tab 23, which is an extension of cover 33 and, when the cartridge 1 is installed in a printer as shown in FIG. 19, is generally above a flat surface 445 of the frame of the printer. Similarly, as shown in FIG. 20, a top flat ledge 447 is an extension of cover 241 and, when cartridge 1 is installed in a printer, is above a flat surface (448 of FIG. 10) of the frame of the printer.

A flat bottom surface 449 (FIG. 19) is under tab 23 of cover 33, and a flat bottom surface 451 (FIG. 20) of cover 245 is under ledge 447. Bottom surfaces 449 and 448 are locator surfaces which rest on frame surfaces 445 and 448, respectively.

FIG. 21 shows the right side of cartridge 1 installed in a printer with emphasis on cantilevered roller 461 pressing down on locator surface 29b. A second cantilevered roller (not shown), which is a mirror image of roller 461 exists and presses down on locator surface 29a. Roller 461 and its mirror image roller are attached to the frame of the printer. They are firmly biased downward by a coil spring 463 for roller 461 and a mirror image coil spring for the mirror image roller. As the cartridge 1 is inserted in the printer by movement of wing 9a in guides 293, 297 and wing 9b in corresponding mirror image guides, locator surface 29b encounters cantilevered roller 461 and locator surface 29a encounters a corresponding mirror image cantilevered roller; and the locator surfaces 29a, 29b rotate those rollers upward as the cartridge 1 continues to move.

When wing 9a falls off of guide 293 and is finally positioned by shaft 47 settling in V-block 301, cantilevered roller 461 fully contacts surface 29b, as shown in FIG. 21. When the top cover of the printer is closed, a downwardly positioned leaf spring on the printer cover contacts tab 23 on the left front of cover 33 and a second downwardly posi-

tioned spring on the printer cover contacts surface 447 on right cover 241. Such interaction of a cartridge with a printer lid is generally conventional, as illustrated by U.S. Pat. No. 5,365,315 to Baker et al.

As the printer lid is closed, a charge roller mechanism is moved to shutter 5 and then continues to move downward to open shutter 5 by pushing it downward and to bring a charge roller in contact with photoconductor drum 49. A laser beam for discharging drum 49 is also directed through the opening left after shutter 5 is pivoted down, as is shown on U.S. Pat. No. 5,526,097 to Ream.

In summary, the photoconductor and cover assembly is located downwardly by front surfaces 449 and 451, is located downwardly by shaft 47 in V-block 301 and in the mirror image V-block and is held in the downward location by cantilevered roller 461 on surface 29b and the mirror image cantilevered roller on surface 29a. The developer assembly is located laterally by springs 132a and 132b moving the assembly so that developer roller 43 contacts the photoconductor drum 49, and is located downwardly by ledge 133a resting on roller 299 and ledge 161a resting on the mirror image roller to roller 299. The developer assembly requires no upward locator as it has sufficient weight not to displace upward.

Ledges 133a and 161a resting on roller 299 and a mirror image roller respectively permit the developer assembly to adjust laterally. In prior cartridges, both sets of rollers were in tracks in the cartridge. This required difficult tolerances to locate the bottom of the cartridge within the printer. In the subject cartridge, ledges 133a and 161a have no linked parts to the media guide ribs 223 and 225, which are in the same molded part as ledges 133a and 161a.

FIG. 22 shows an extension of side member 99 held in a slot 471 in the bottom of the cover 25. This provides lateral location between the hopper assembly and the cover 25. Generally similar lateral location structure is provided in previous cartridges. If desirable, the upper parts of end members 99 and 101 may have an upward ridge or bump, which will strike cover 25 during rough handling and thereby limit relative upward movement of the hopper assembly with respect to cover 25.

When installed in the printer, frame members contact left cover 31 and right cover 241 to assure they do not contact the hopper assembly and interfere with its free movement over roller 299 and its mirror image roller on ledges 133a and 161a respectively.

#### Venting By Plug

Plug 143 (FIG. 24) in a preferred form is a venting element which allows air to escape cartridge 1 while blocking toner. Cartridge 1 in the embodiment disclosed is designed to operate at high speed to print from 8 to 24 or more standard pages per minute. This operation generates a potentially detrimental internal pressure level during operation, which contributes to leaks of toner from cartridge 1. To relieve such pressure, plug 143 is a labyrinth design ending in a felt filter.

The leaks often, but not exclusively, occur immediately after the cartridge becomes inactive. Internal pressure in hopper 61 is created by ingesting air with toner 425 carried by the developer roller 43 past a seal (not shown) under the developer roller 43. The toner adder roller 45 pulls this air/toner mixture away from the developer roller which creates a pressure increase in hopper 61 until an equilibrium pressure is reached. As shown in FIG. 23, plug 143 is formed from a single molded part 481 having a circular base

member 483 and a circular cap member 485 separated by a thin connecting arm 487, which has a central notch 489 to permit bending as a solid hinge.

Base 483 has a series of equally separated external holes 491 around the entire bottom circumference of base 483. Extending from the bottom of base 483 and located inward is a circular wall 493 having spaced rectangular openings 495 at the outer end of wall 493 equally spaced around the entire circumference of wall 493.

Similarly, cap 485 has a circular wall 497 extending from the top of cap 485 having spaced rectangular openings 499 at the outer end of wall 497 equally spaced around the entire circumference of wall 497. A disk 501 of standard F3 felt is pressed into the center of cap 485 where it contacts the inside of holes 503 (FIG. 24) in the center of cap 485.

To complete plug 143 as shown in FIG. 24, cap 485 and base 483 are intermeshed by folding arm 487 at hinge point 489. In this position no part of openings 499 is opposite external holes 491 and no part of openings 495 is opposite holes 499. FIG. 25 is a staggered cross section view of FIG. 24 which shows all of the openings 495 and 499 and indicates the staggered path by the angles 505a and 505b in discussion arrow 505.

As shown in FIG. 25, the plug is held together by a press fit in which the bottom circumference of base 483 is slightly smaller than the circumference of cap 485. In operation, when pressure increases in cartridge 1, air, potentially containing toner particles, enters holes 491 which are inside of hopper 61. That air enters circular chamber 507, as illustrated by arrow 505, and is blocked by wall 497 immediately opposite hole 491 and, therefore, must move right or left, as illustrated by bent arrow 505a, to reach openings 499. The air then enters chamber 509. That air is blocked by wall 493 and also must move right or left, as illustrated by bent arrow 505b, to reach openings 495, which are on the opposite end of chamber 509. Upon passing through openings 495, as shown by arrow 505, the air enters central chamber 511 and passes through felt filter 501 and then out of cartridge 1 through holes 503. (FIG. 23 shows four central flanges 513a-513d, which divide chamber 511 into four equal parts. However, flanges 513a-513d are for structural support of felt disk 501 and, functionally, chamber 511 can be a single chamber.) The labyrinth configuration of this construction of plug 143 results in continuing operation as an air vent with only minor accumulation of toner inside of the plug 143. The internal chambers 507, 509 and 511 are concentric circles.

We claim:

1. A toner cartridge comprising

a first unitary element comprising hand grip at the top front end; a cleaner chamber at the rear end; and left and right side walls, each said side wall having a housing for loosely receiving a stud positioned in said housing; said element having openings near said chamber to mount a photosensitive roller,

a second unitary member comprising a toner hopper, a post and a stud extending from each side of said hopper, and means to mount a developer roller for rotation to receive toner from said hopper,

a first spring connected between said post of the left side of said second unitary member and said left side wall, a second spring connected between said post of the right side of said second unitary member and said right side wall,

said stud of the left side of said cartridge positioned in said housing of said left side so as to be held by said housing of said left side, and

said stud of the right side of said cartridge positioned in said housing of said right side so as to be held by said housing of said right side.

2. The cartridge as in claim 1 further comprising a flat ledge on the side of said hopper unobstructed for resting on a roller member in said imaging apparatus.

3. The cartridge as in claim 2 further comprising elongated top locator elements on opposite sides of said cartridge in the center of said cartridge.

4. The cartridge as in claim 3 having curved planar members on opposite sides of said cartridge for guided movement, said planar members being substantially continuous with respect to being guided by substantially continuous slots and also comprising a lower shutter mounted on a link on each side to rotate said shutter forward and upward, each said link being integral with an actuator surface located generally above each of said planar members so that insertion of said planar members in a slot will rotate said actuator surfaces toward said wings, said rotation moving said shutter forward and upward.

5. The cartridge as in claim 4 also comprising locating surfaces on each side of said cartridge comprising

a central shaft of said photosensitive roller extending so that said central shaft is unobstructed for serving as a lower locator.

6. The toner cartridge as in claim 5 in which said hopper contains electrophotographic toner for developing electrostatic images.

7. The toner cartridge as in claim 1 in which said hopper contains electrophotographic toner for developing electrostatic images.

8. The toner cartridge as in claim 2 in which said hopper contains electrophotographic toner for developing electrostatic images.

9. The toner cartridge as in claim 3 in which said hopper contains electrophotographic toner for developing electrostatic images.

10. The toner cartridge as in claim 4 in which said hopper contains electrophotographic toner for developing electrostatic images.

\* \* \* \* \*

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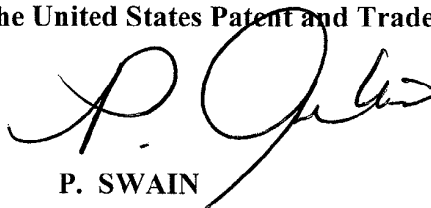
THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
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P. SWAIN  
Certifying Officer





US005875378A

**United States Patent** [19]**Campbell et al.**[11] **Patent Number:** **5,875,378**[45] **Date of Patent:** **Feb. 23, 1999**[54] **TONER CARTRIDGE WITH HOPPER EXIT AGITATOR**[75] Inventors: **Alan Stirling Campbell; Kermit Arnold Meece; Gregory Lawrence Ream**, all of Lexington, Ky.[73] Assignee: **Lexmark International, Inc.**, Lexington, Ky.[21] Appl. No.: **770,328**[22] Filed: **Dec. 20, 1996**[51] Int. Cl.<sup>6</sup> ..... **G03G 15/08**[52] U.S. Cl. .... **399/263; 399/119; 399/260**[58] Field of Search ..... **399/263, 260, 399/11, 119, 258, 259, 262, 261; 222/DIG. 1**[56] **References Cited****U.S. PATENT DOCUMENTS**

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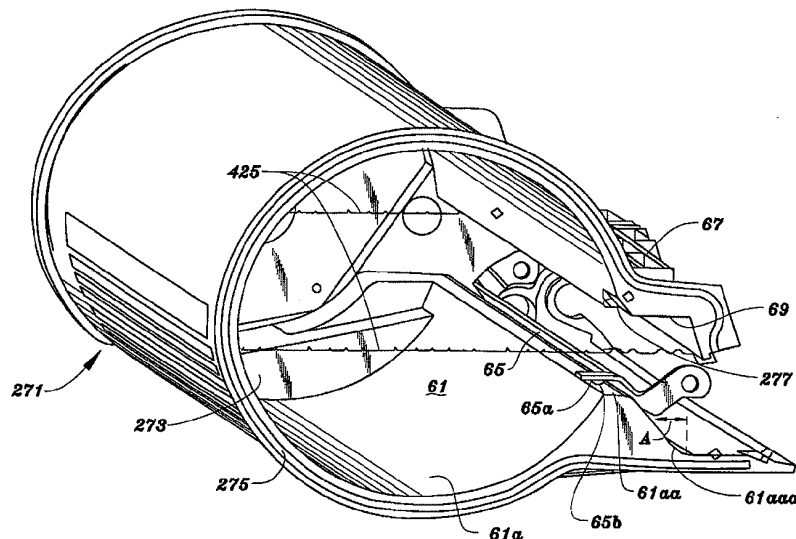
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*Primary Examiner*—William J. Royer  
*Assistant Examiner*—Quana Grainger  
*Attorney, Agent, or Firm*—John A. Brady

[57] **ABSTRACT**

A toner cartridge (1) has a cylindrical toner hopper (61) with a rear wall (61a) defining an output opening well above the lower part of the hopper. A paddle (63) is rotated in the hopper. The exit surface (61aaa) declines downward to form a chamber for the toner adder roller (45) and developer roller (43). This configuration discourages toner from returning to the hopper after it has been electrically charged.

To improve movement of toner past the opening an agitator bar (65) extends across the cartridge near the exit surface. The bar is pivoted at both ends and has a portion (65a) which extends into the path of the paddle. As the paddle rotates, it moves the agitator upward until the curved paths of the two members reach separation, at which time the bar drops by gravity. The bar jars toner loose and eliminates jams of toner. The flat surface of the bar, when it has been moved up, partially blocks the exit opening, which desirably limits toner flow.

**24 Claims, 23 Drawing Sheets**

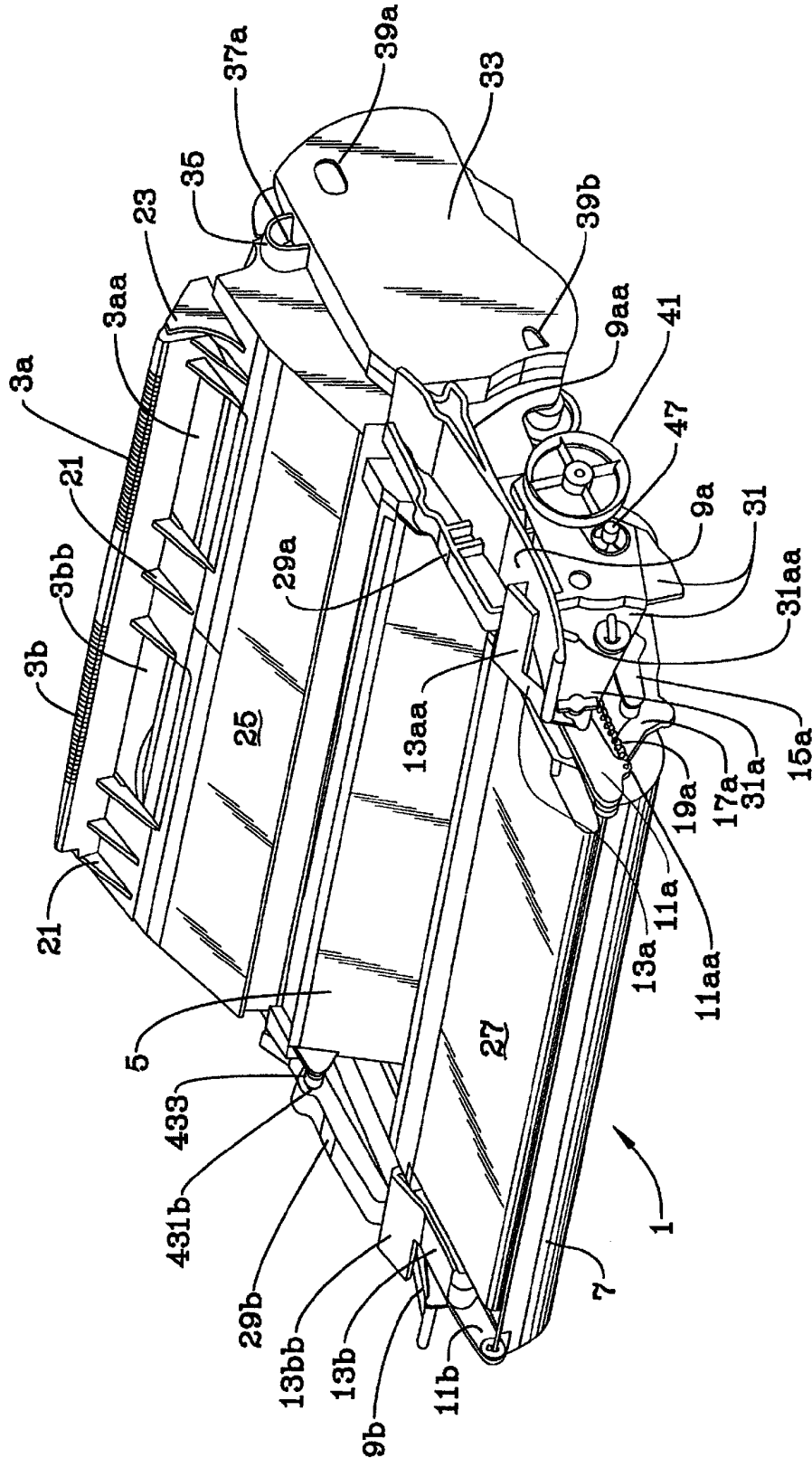
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FIG. 1



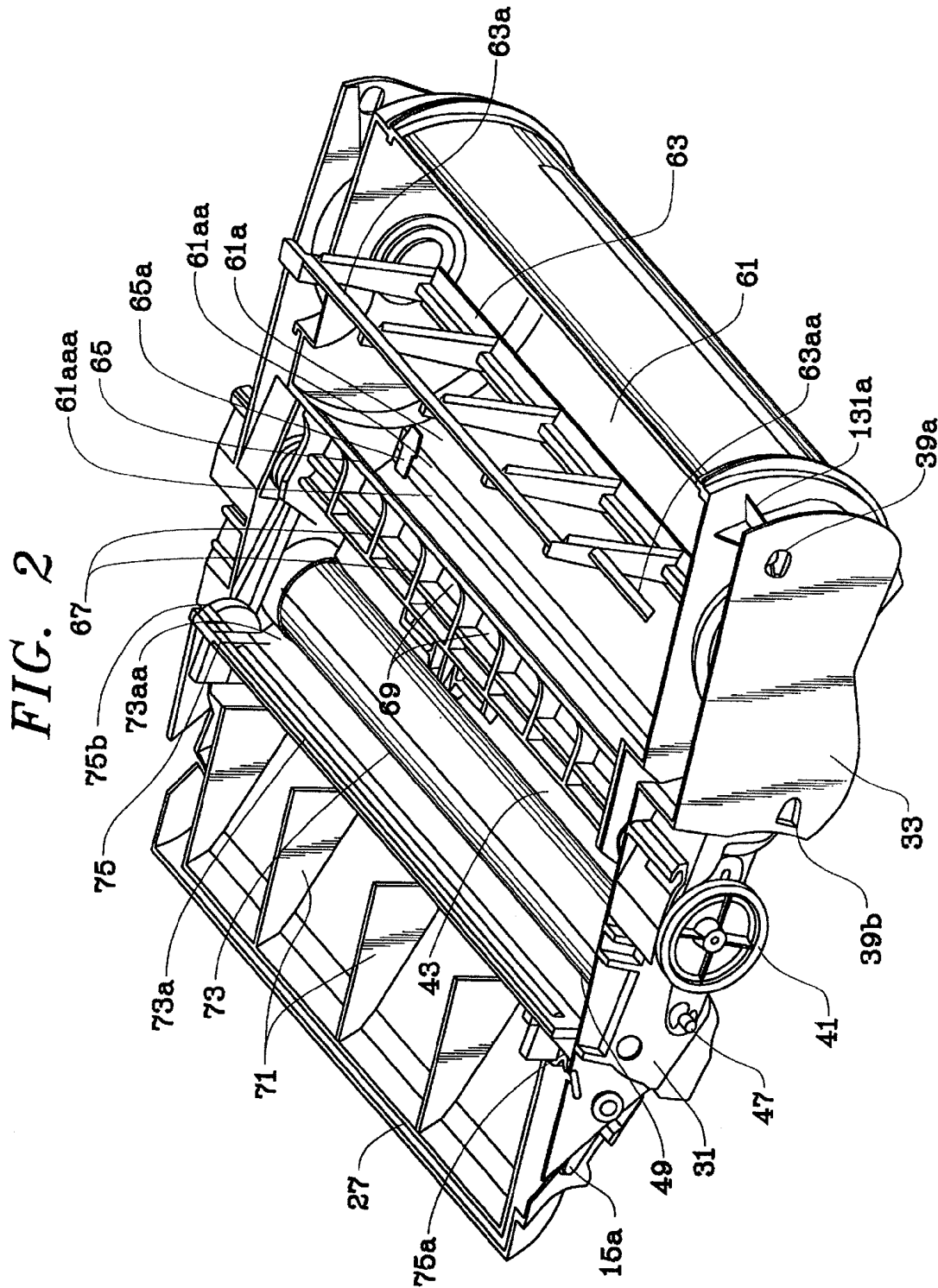
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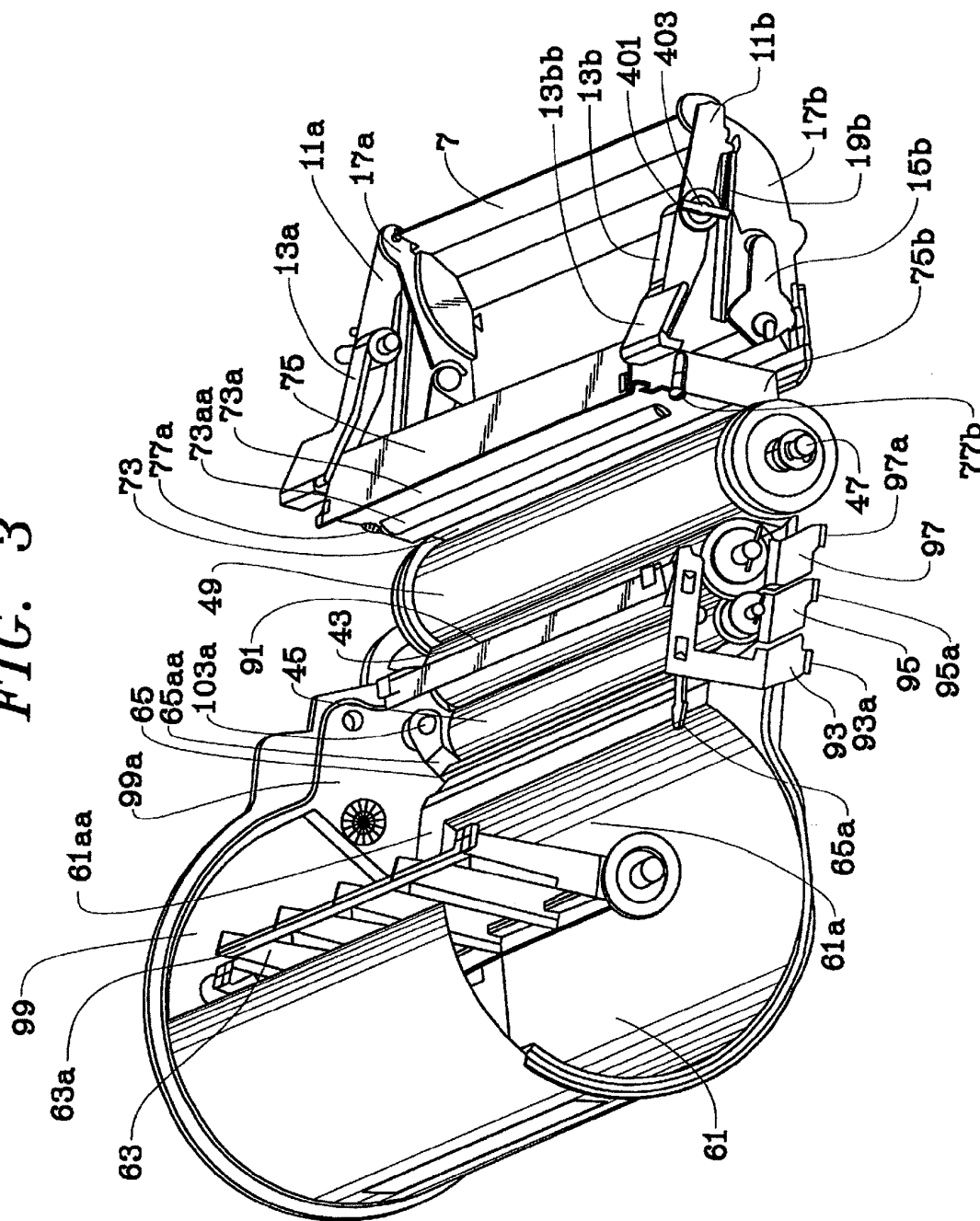
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**FIG. 3**

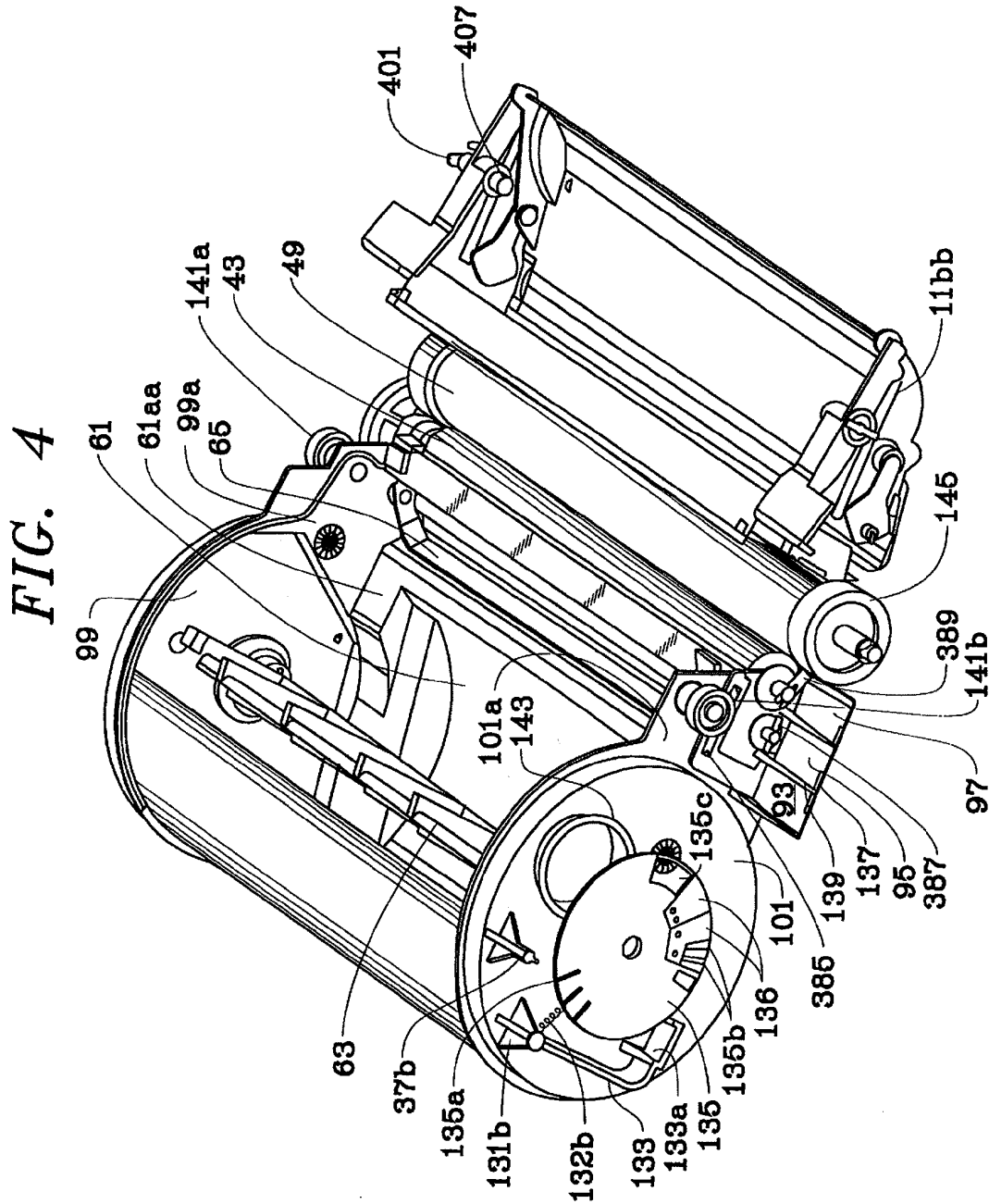


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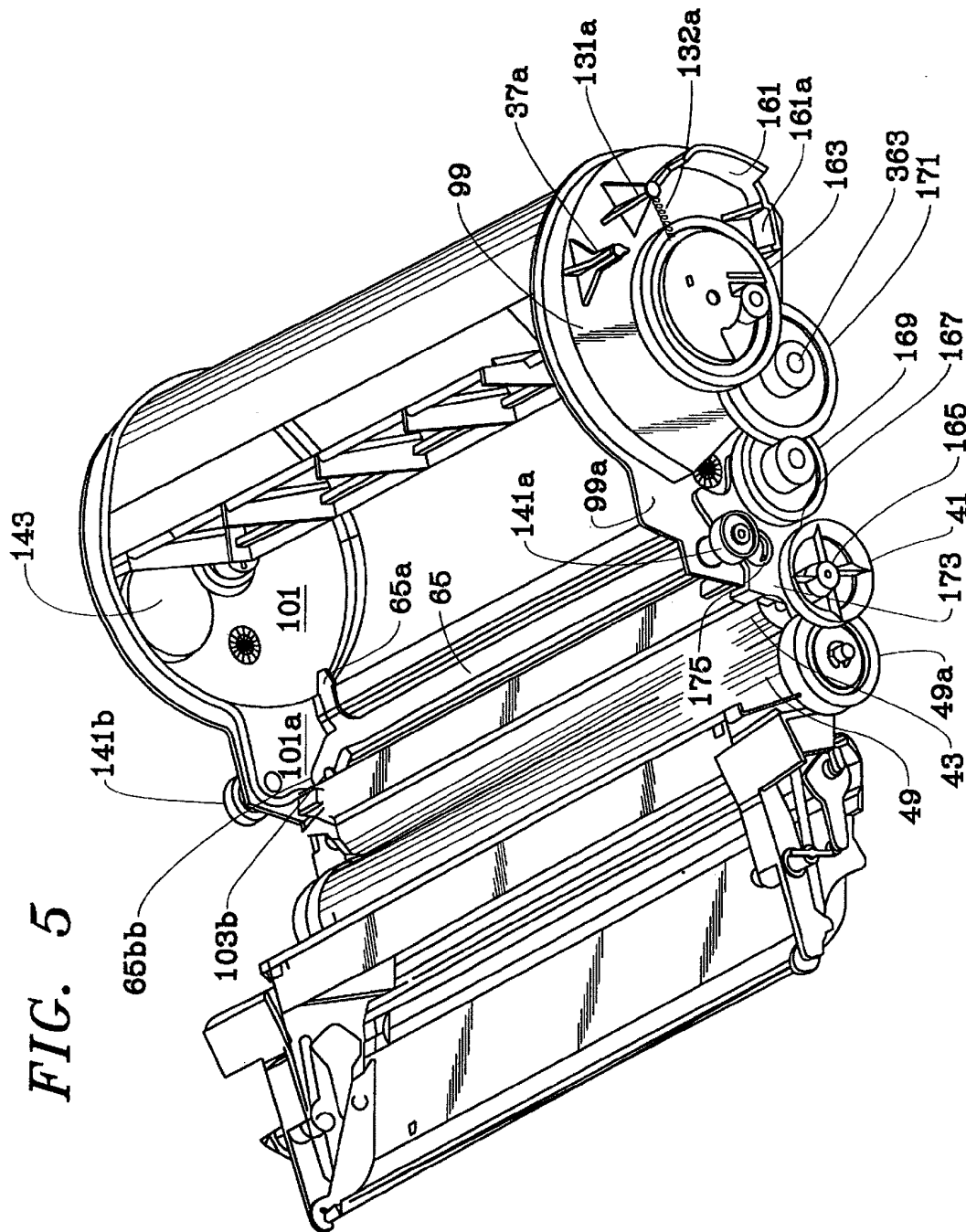


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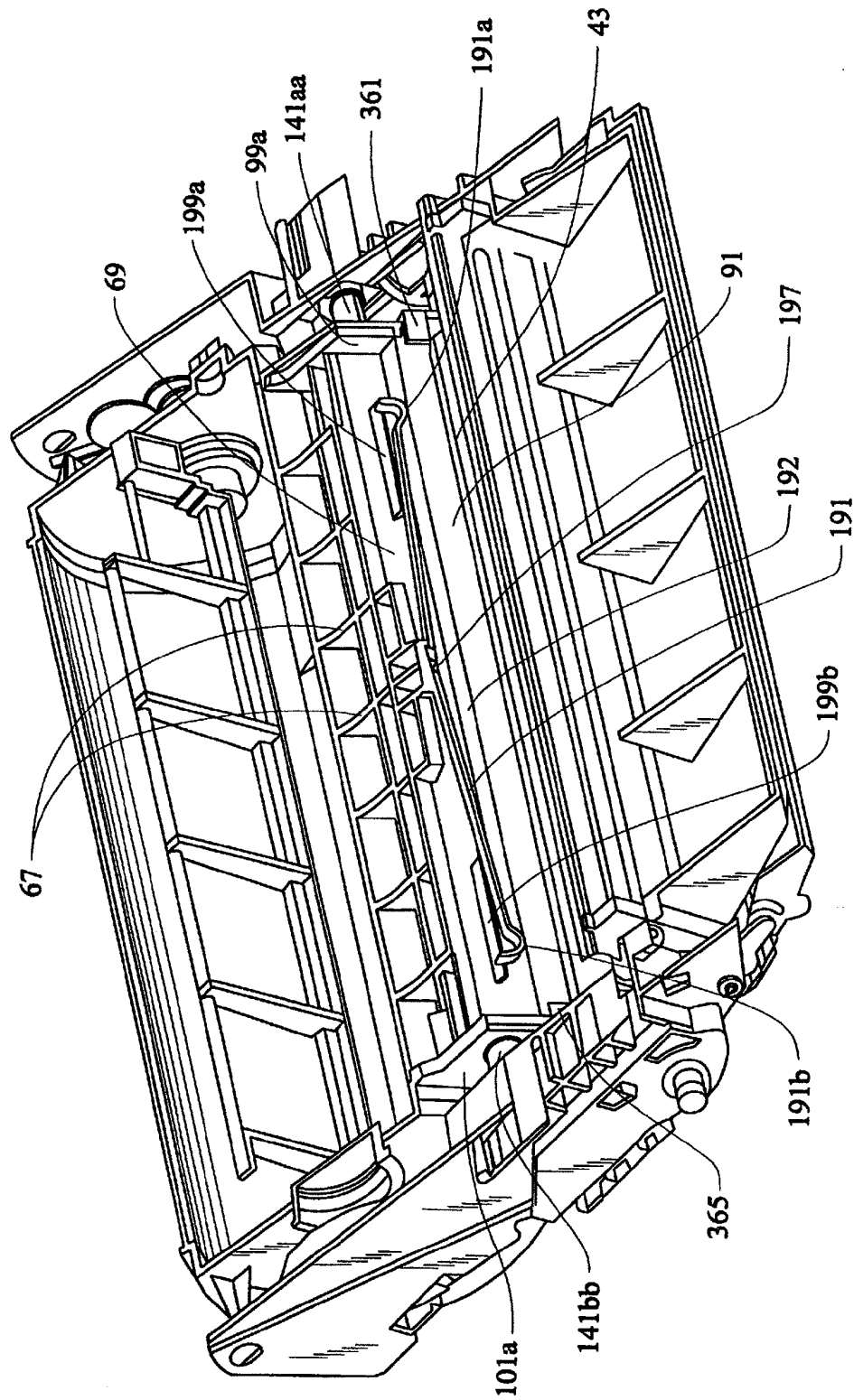
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FIG. 6



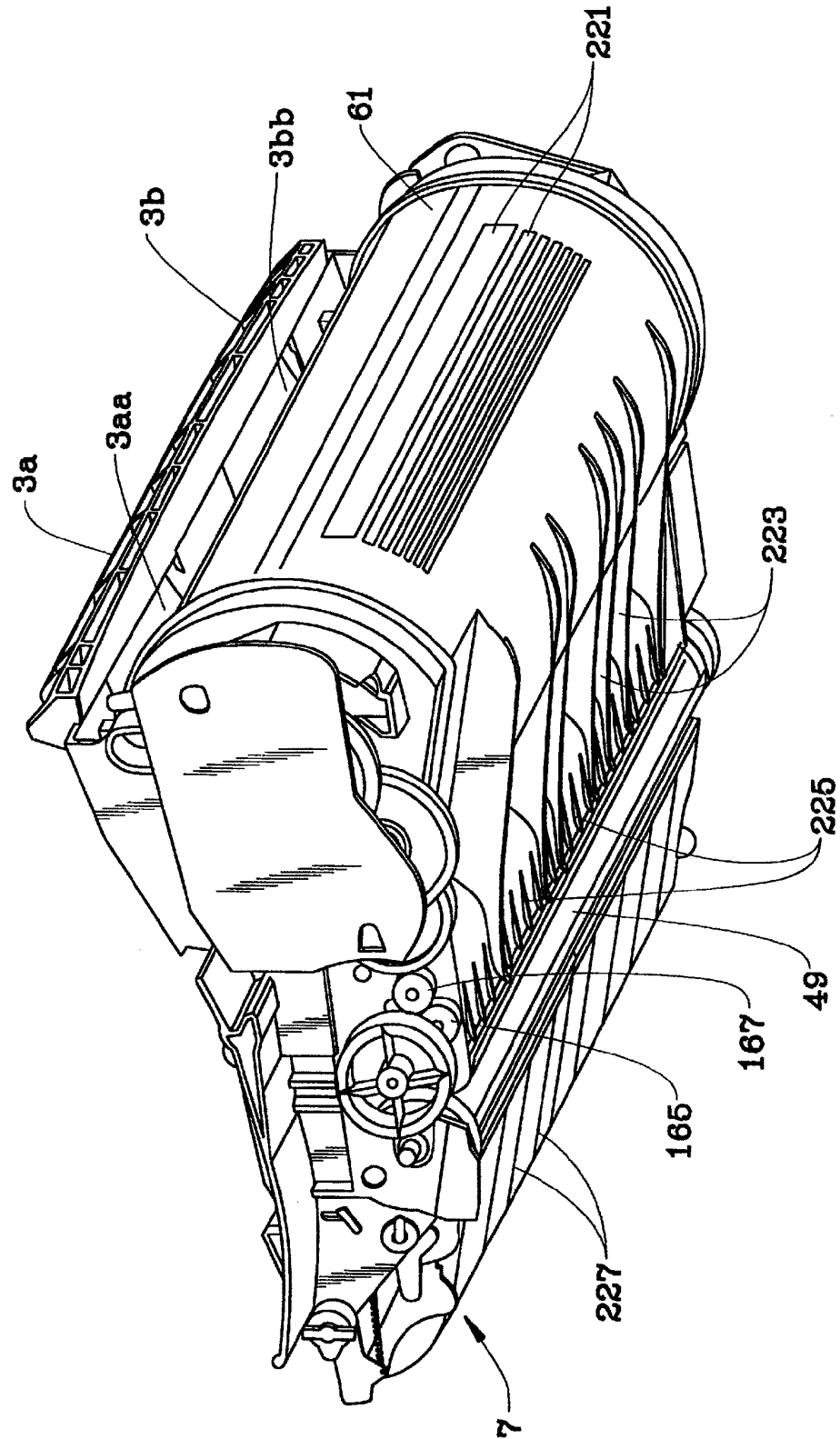
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FIG. 7



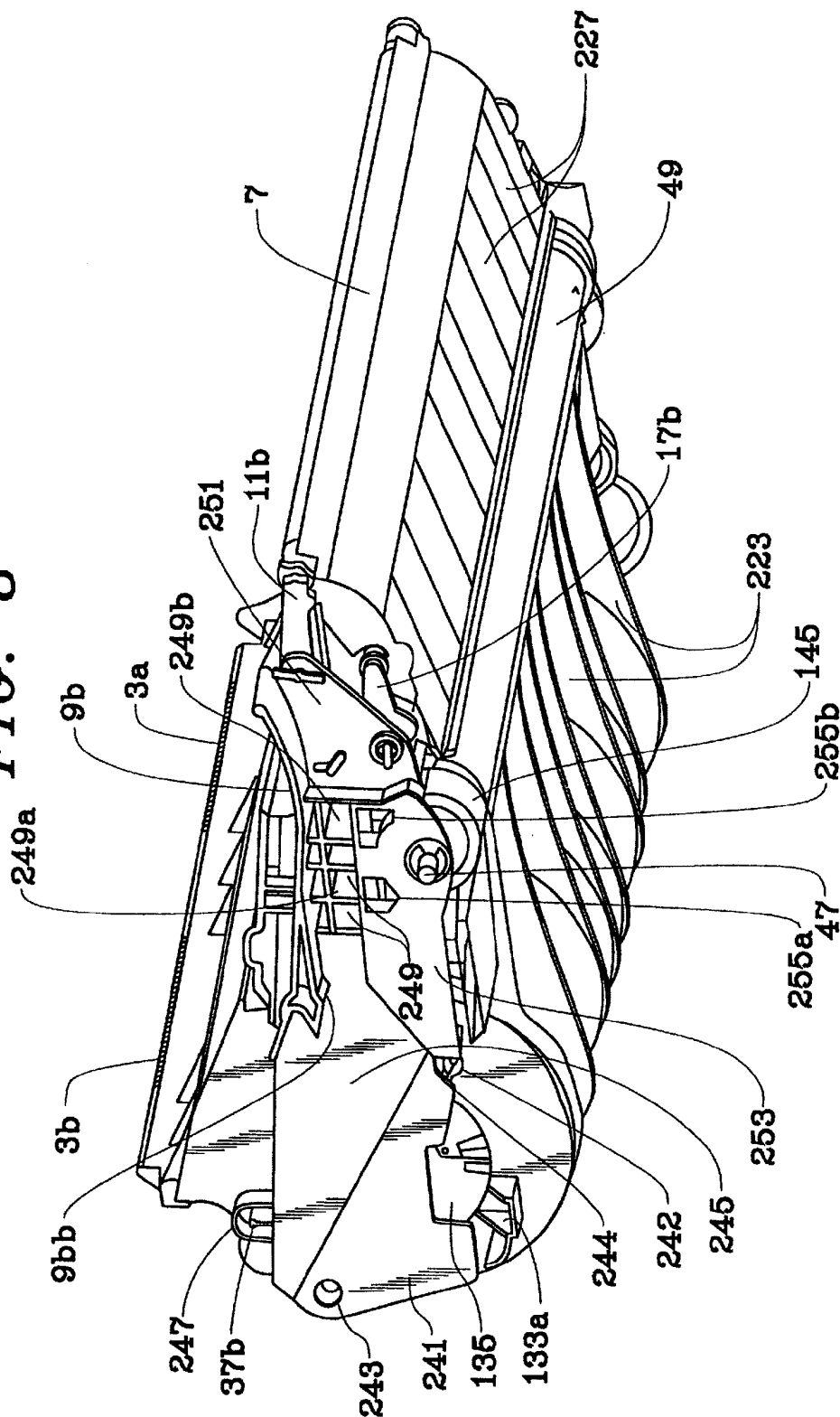
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FIG. 8





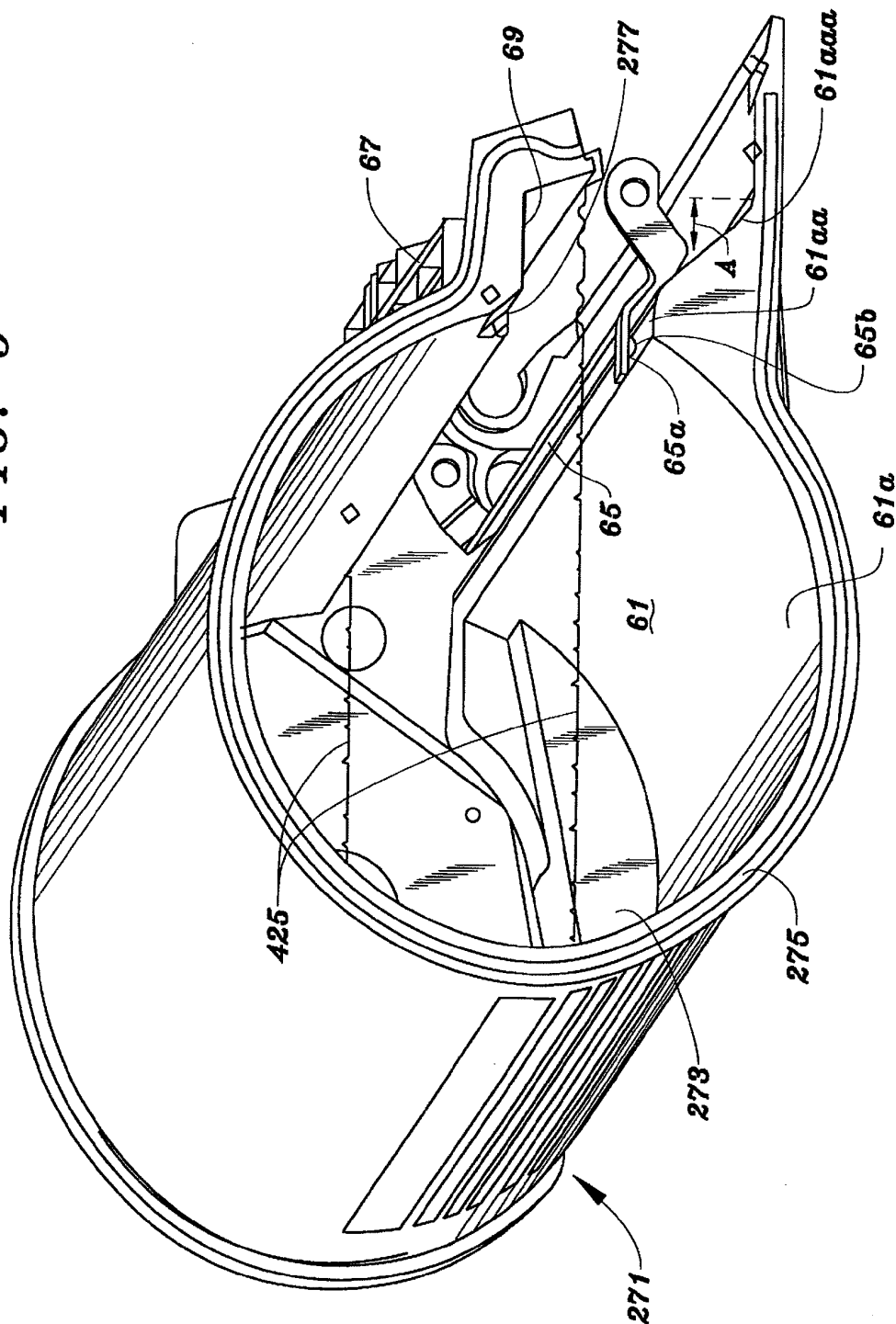
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**FIG. 9**



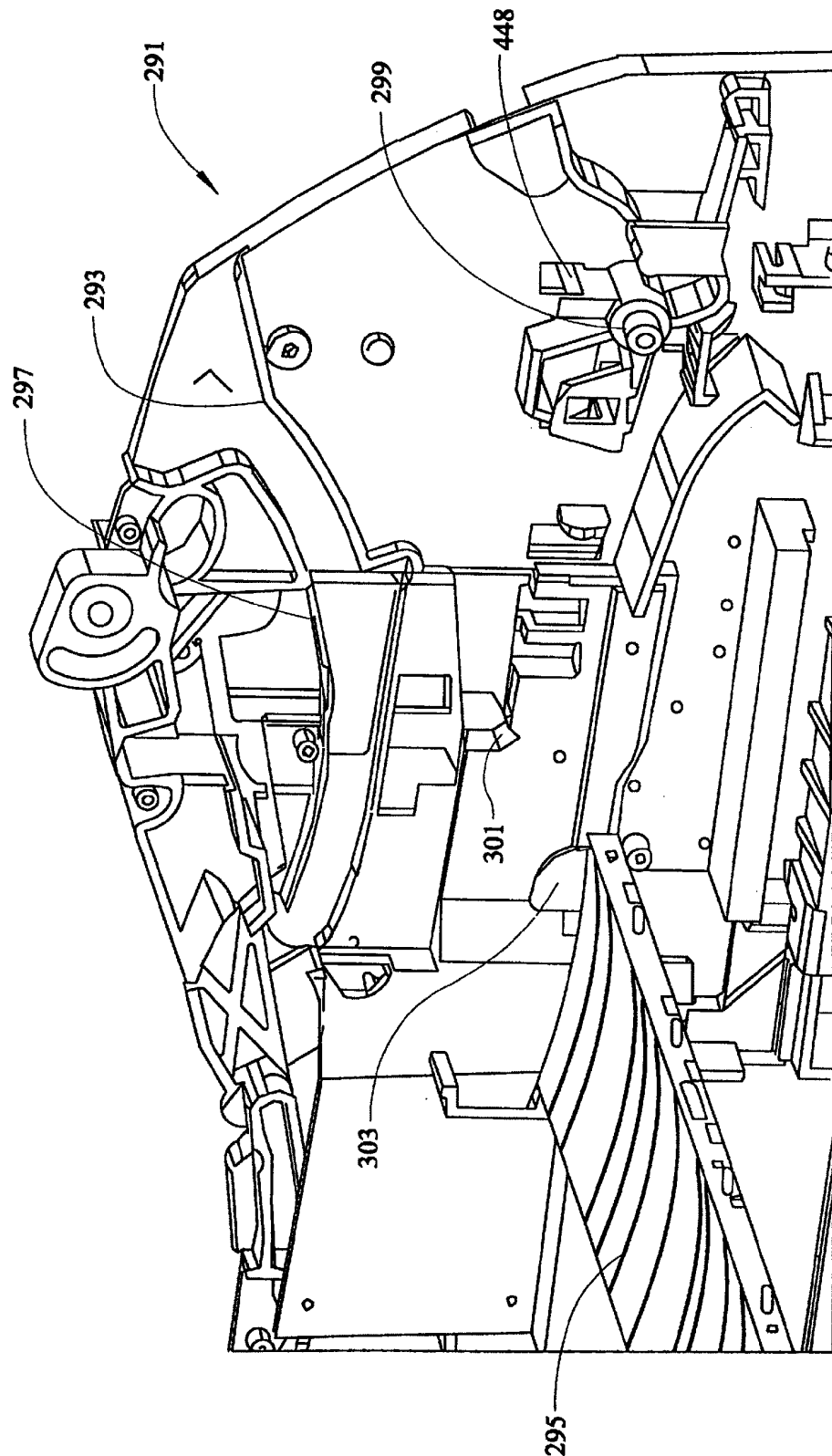
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FIG. 10



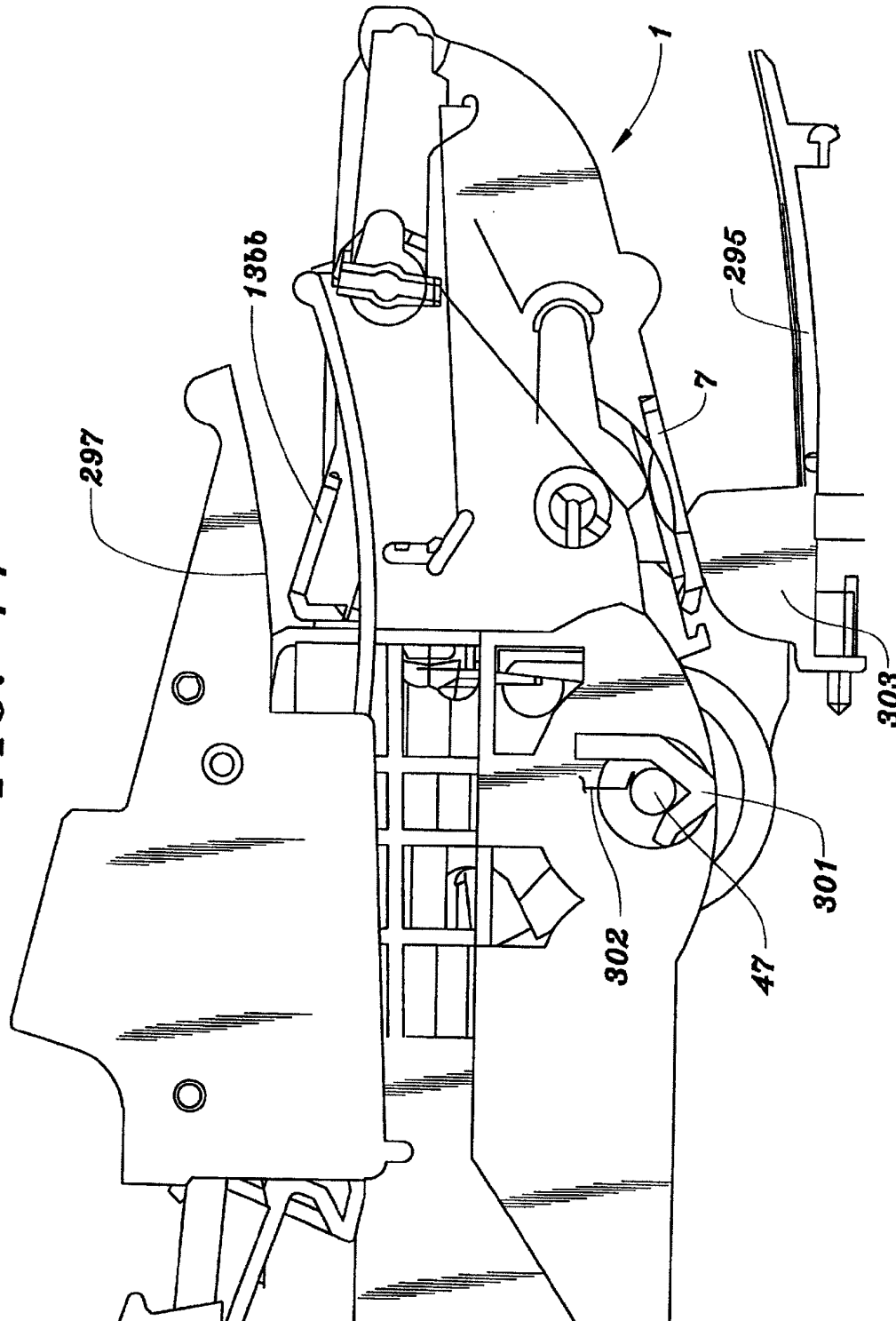
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FIG. 11

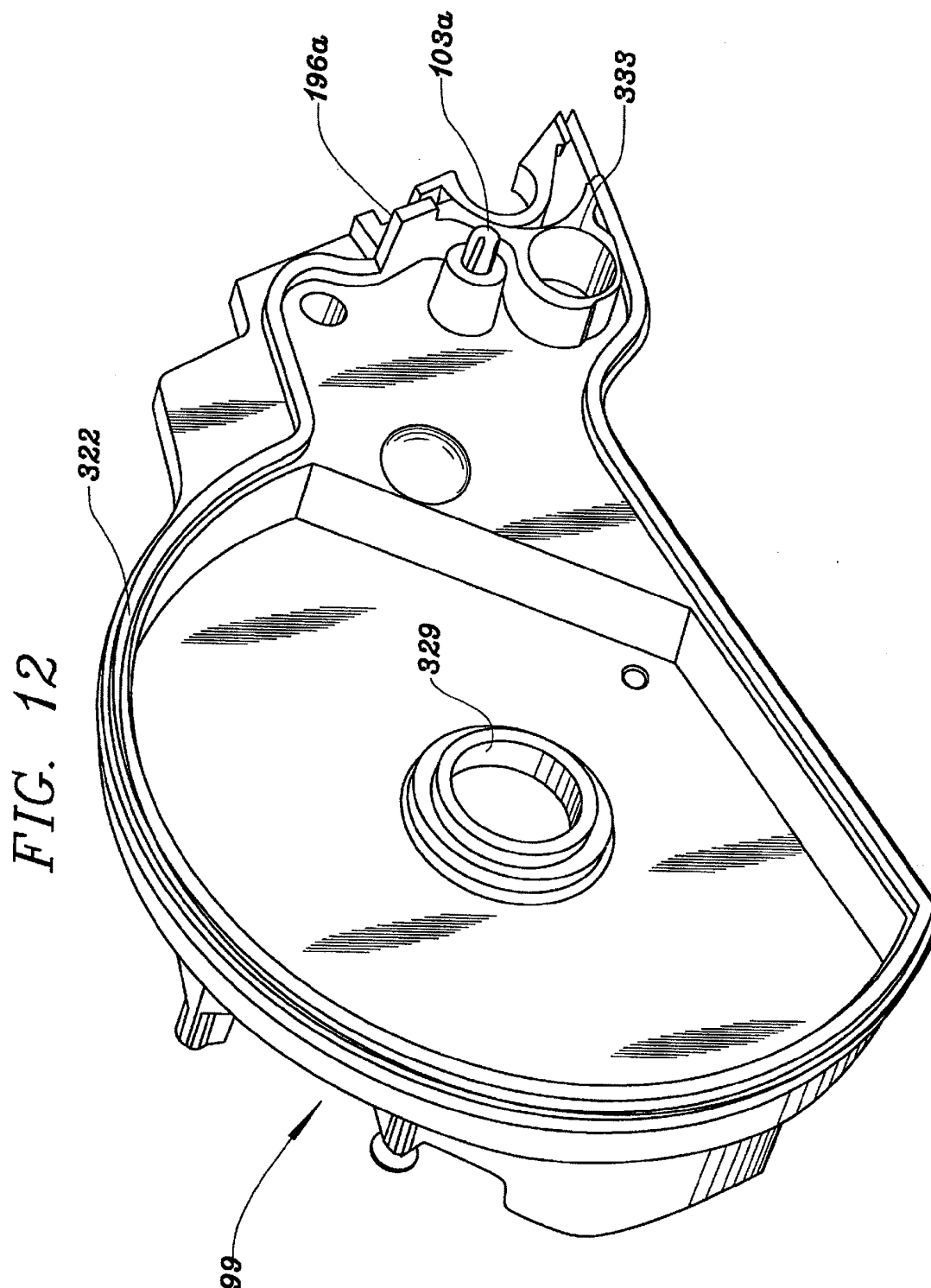


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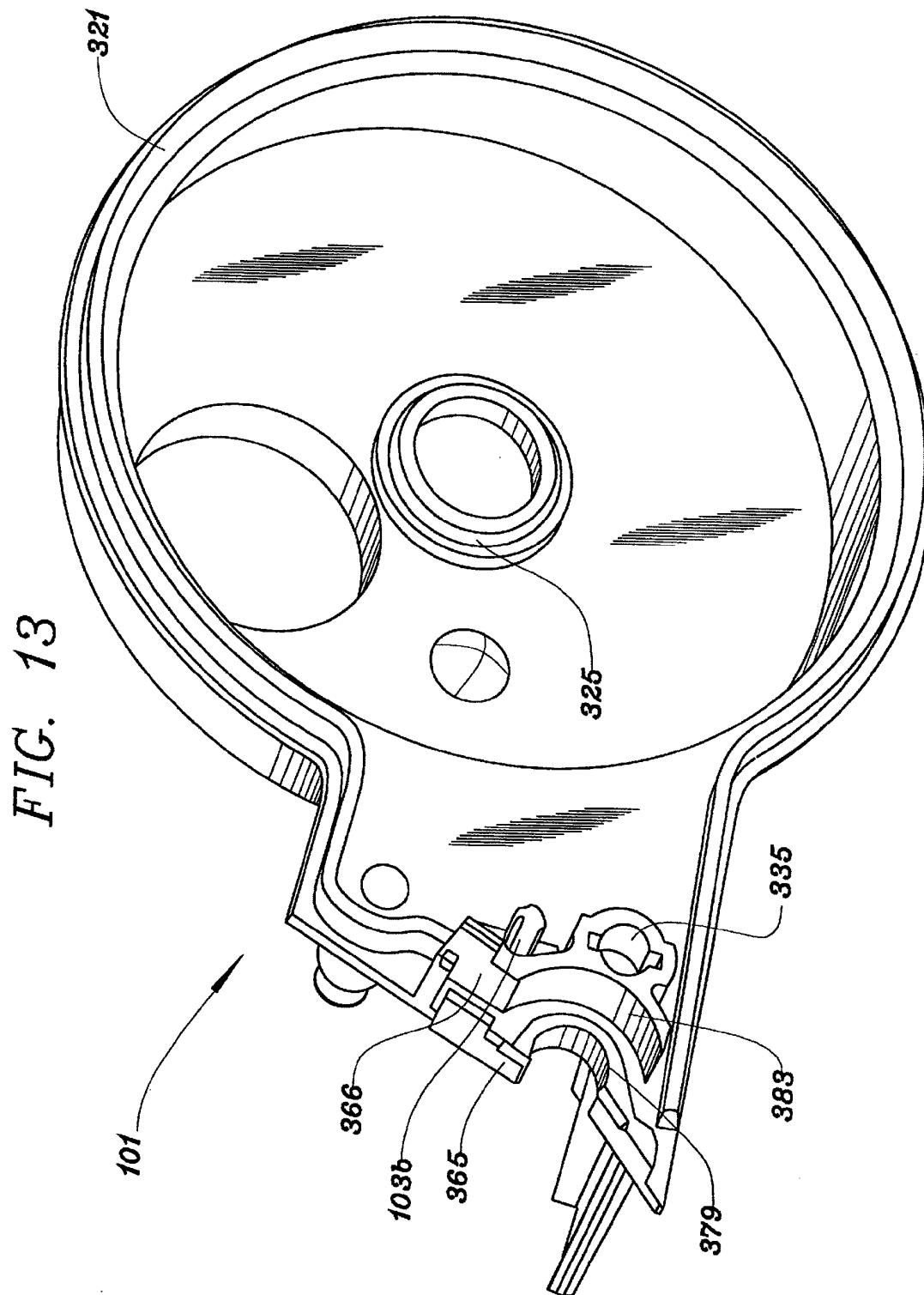
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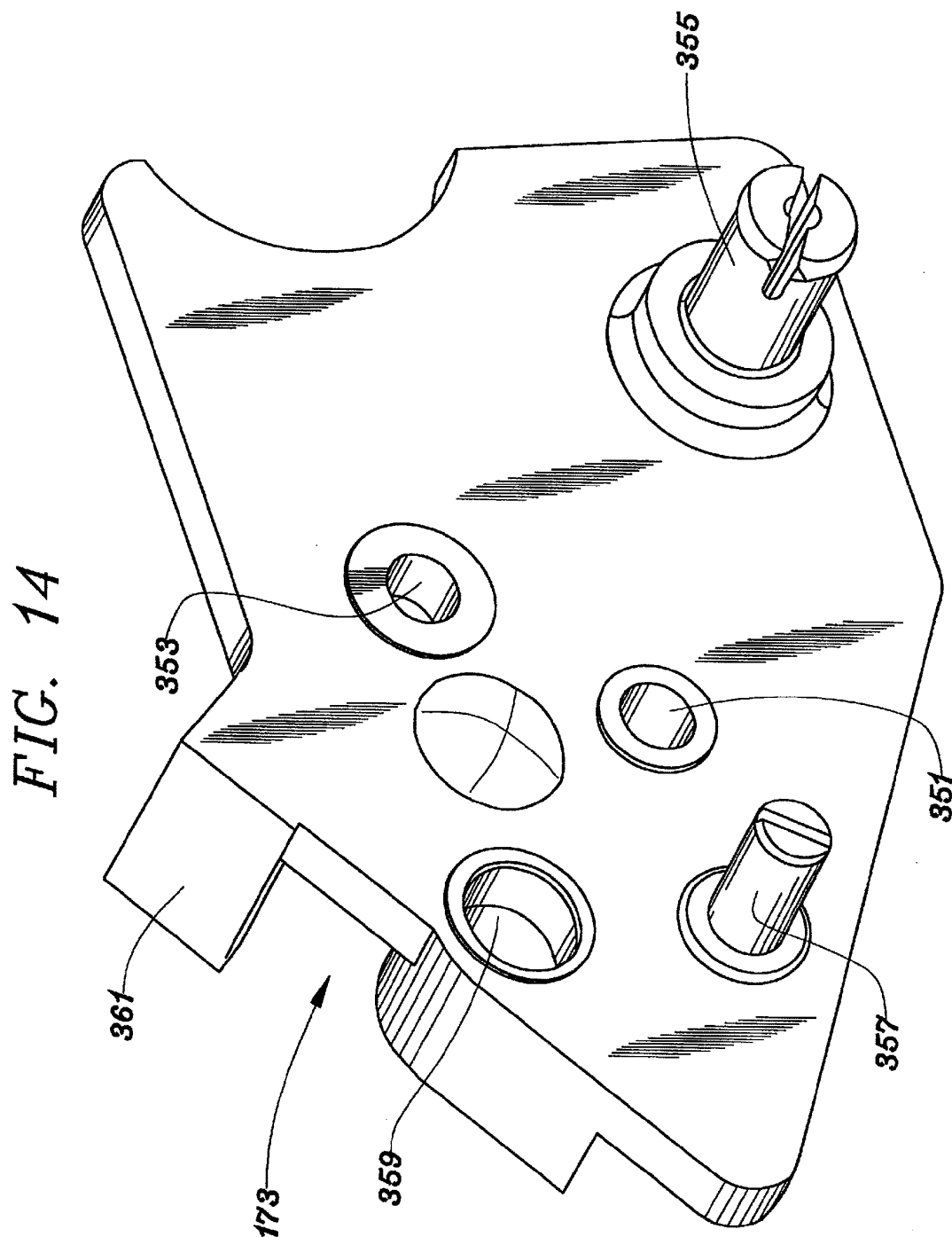
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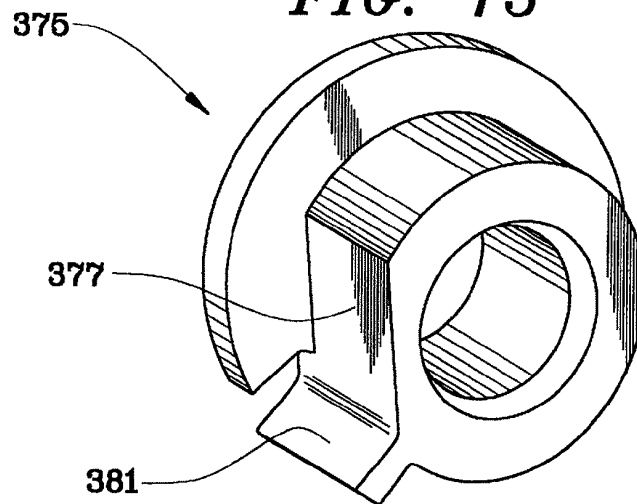
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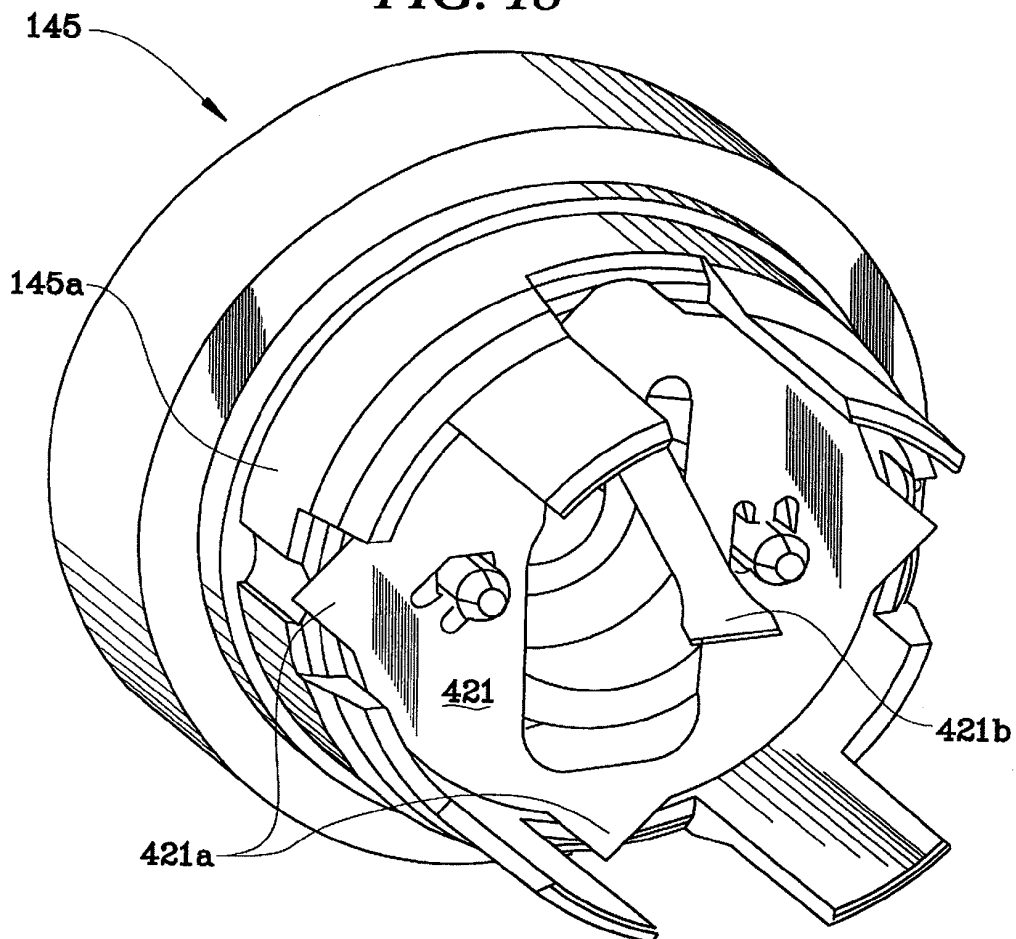
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**FIG. 15**



**FIG. 18**



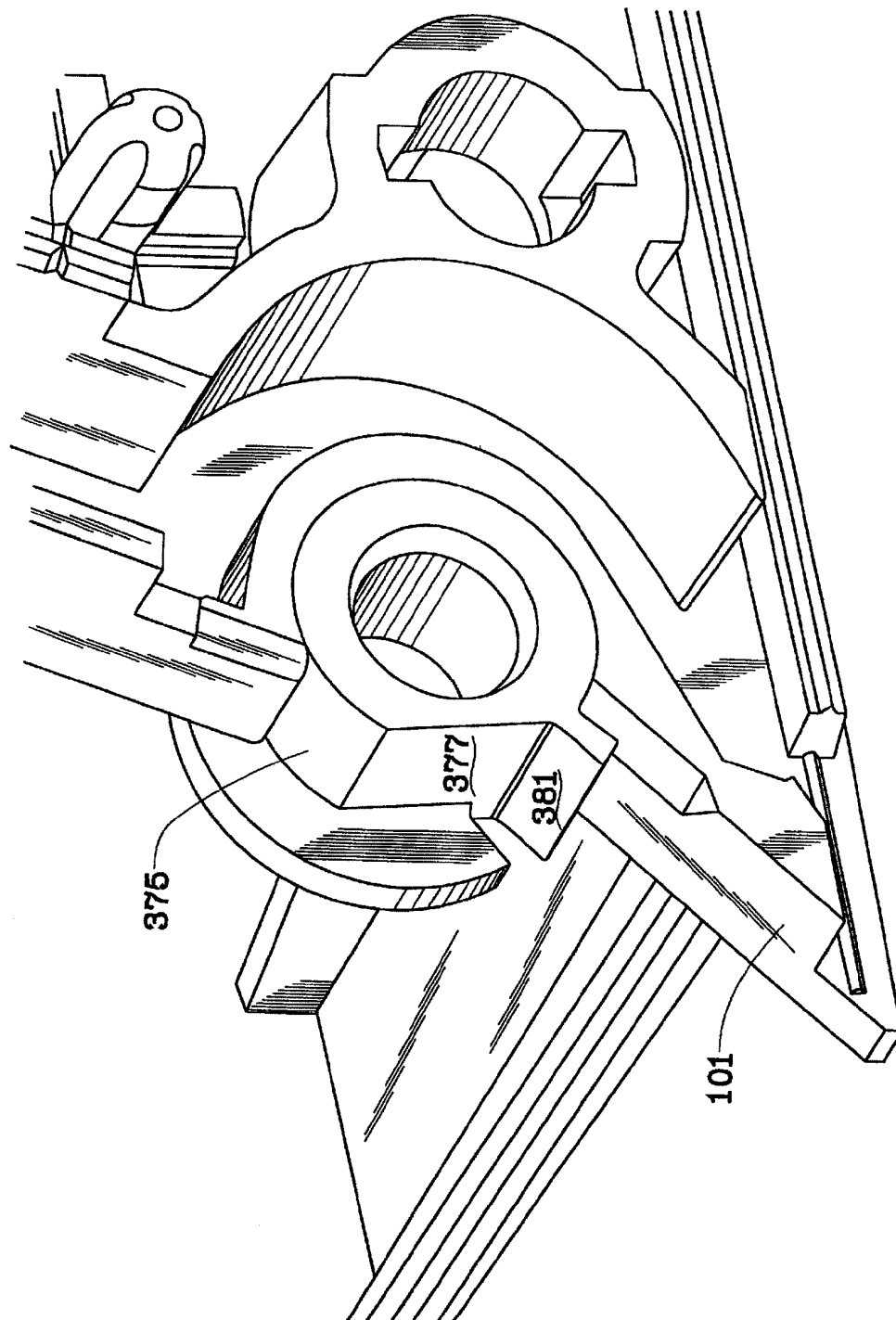
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FIG. 16



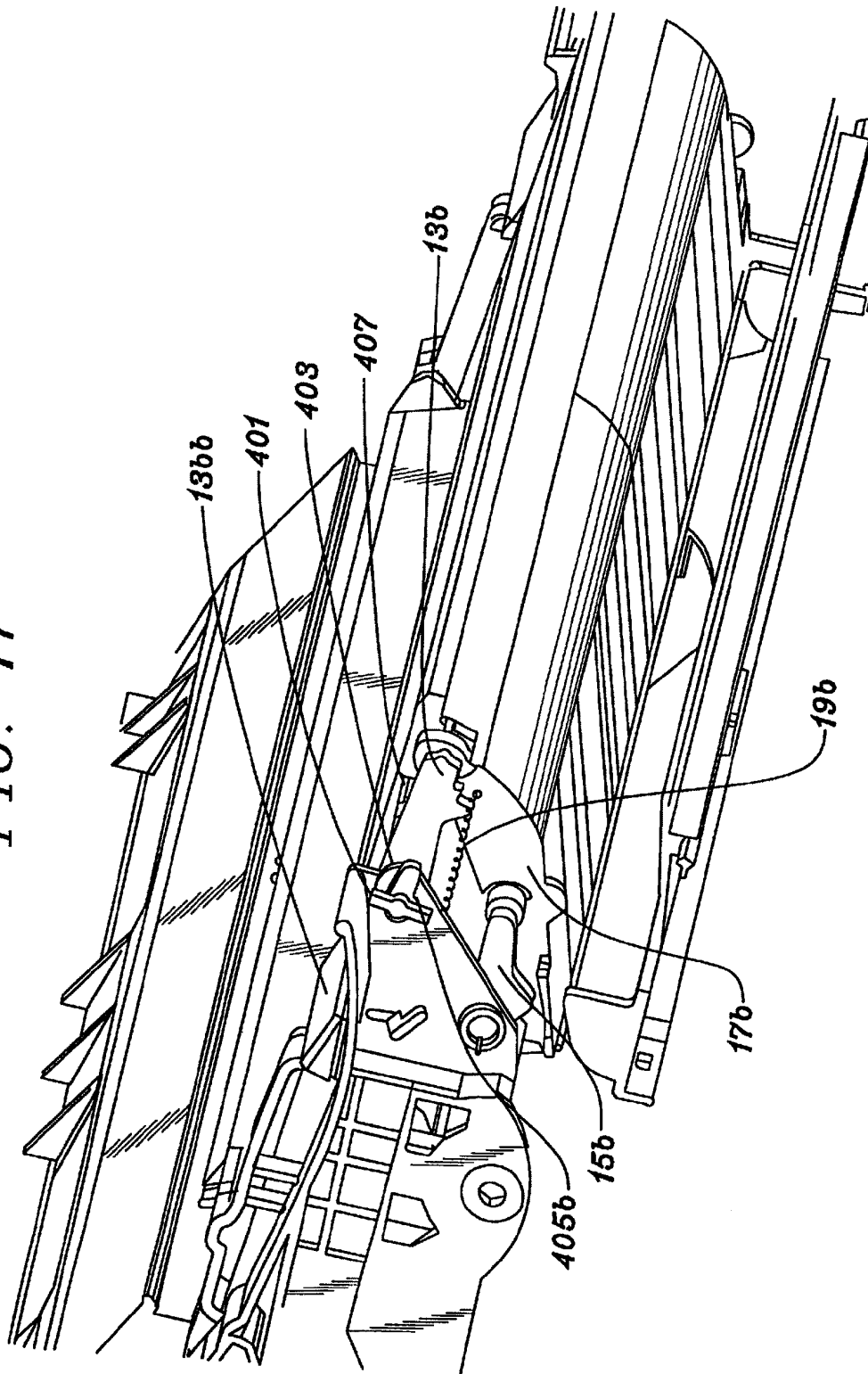
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FIG. 17

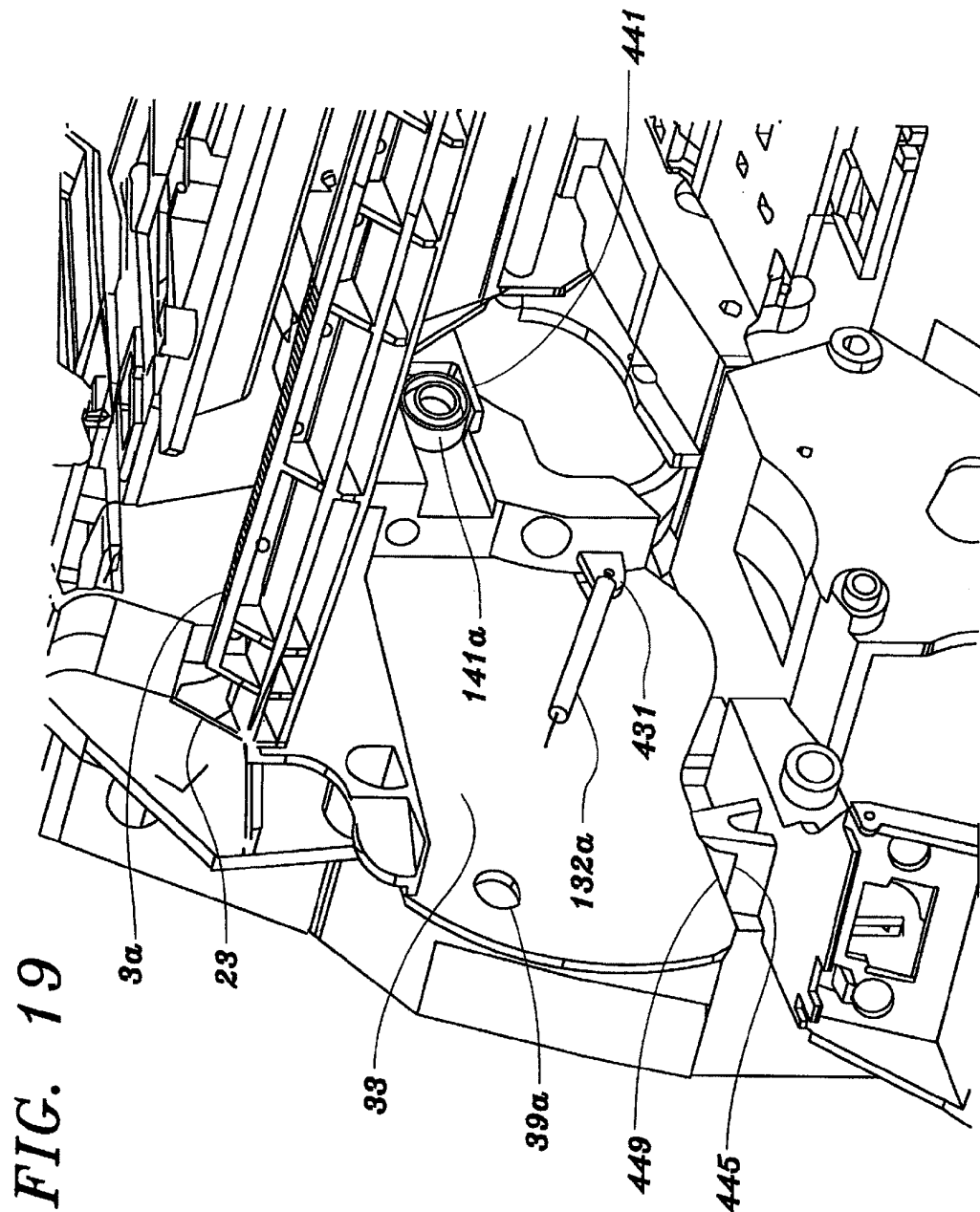


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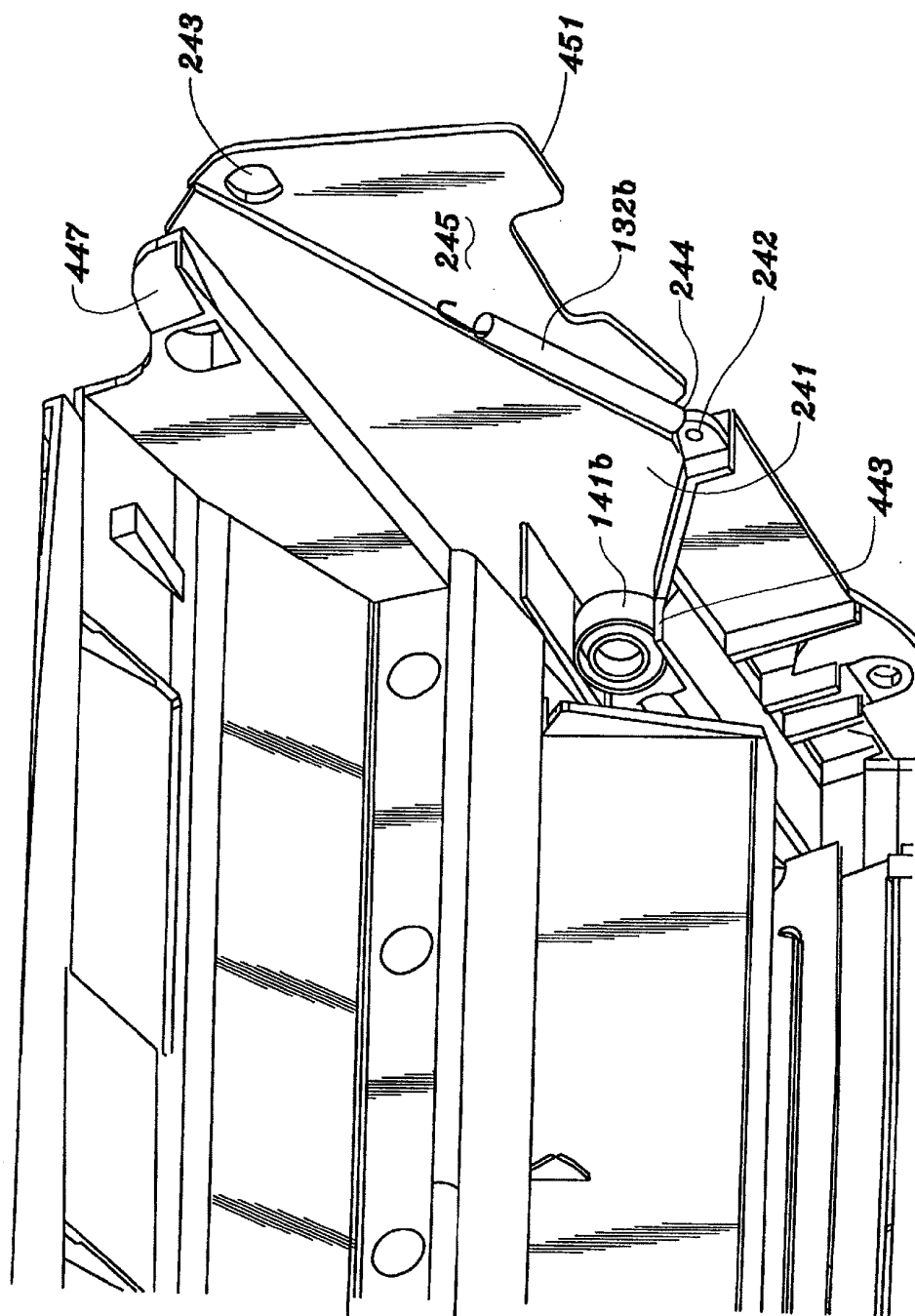
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FIG. 20



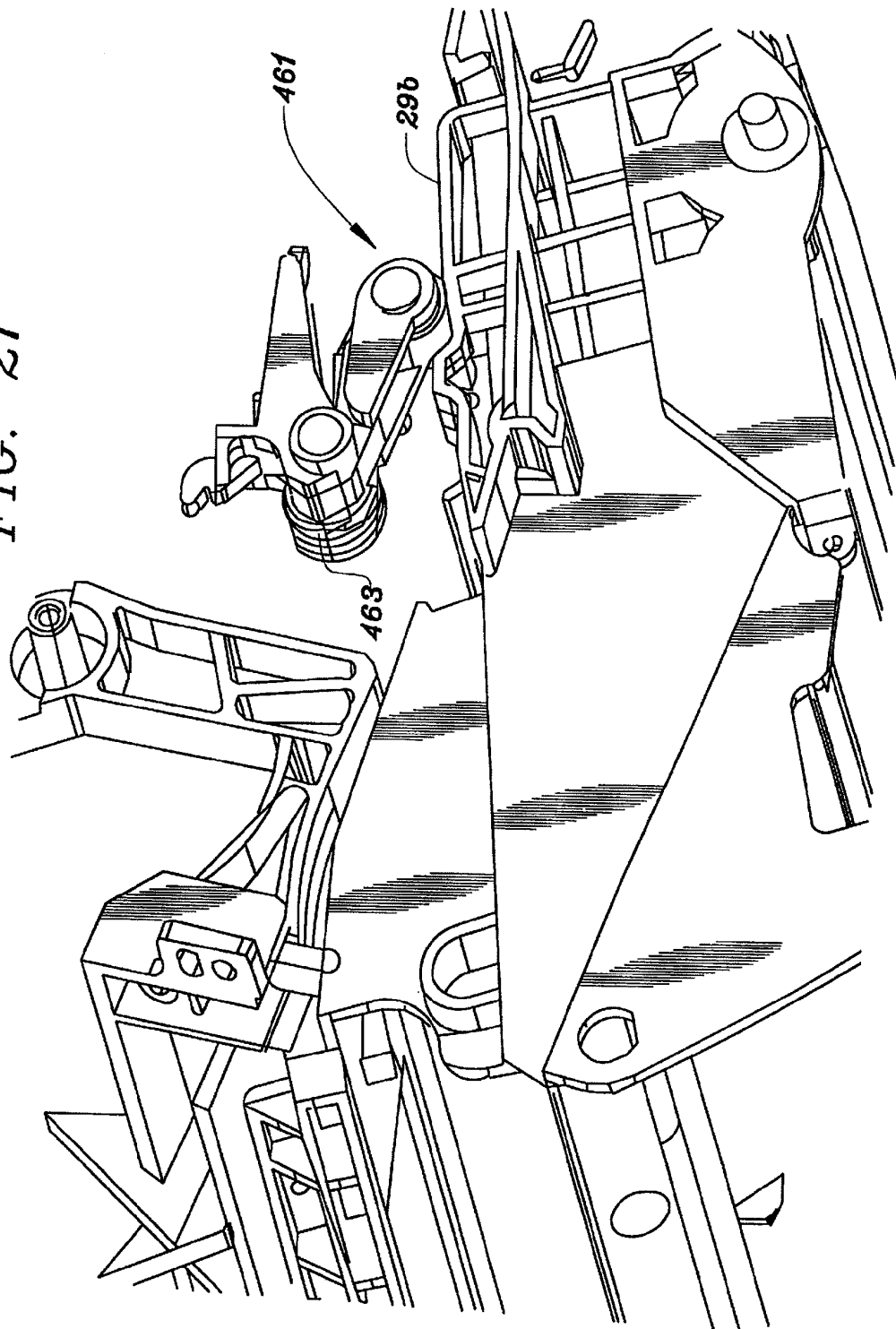
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FIG. 21





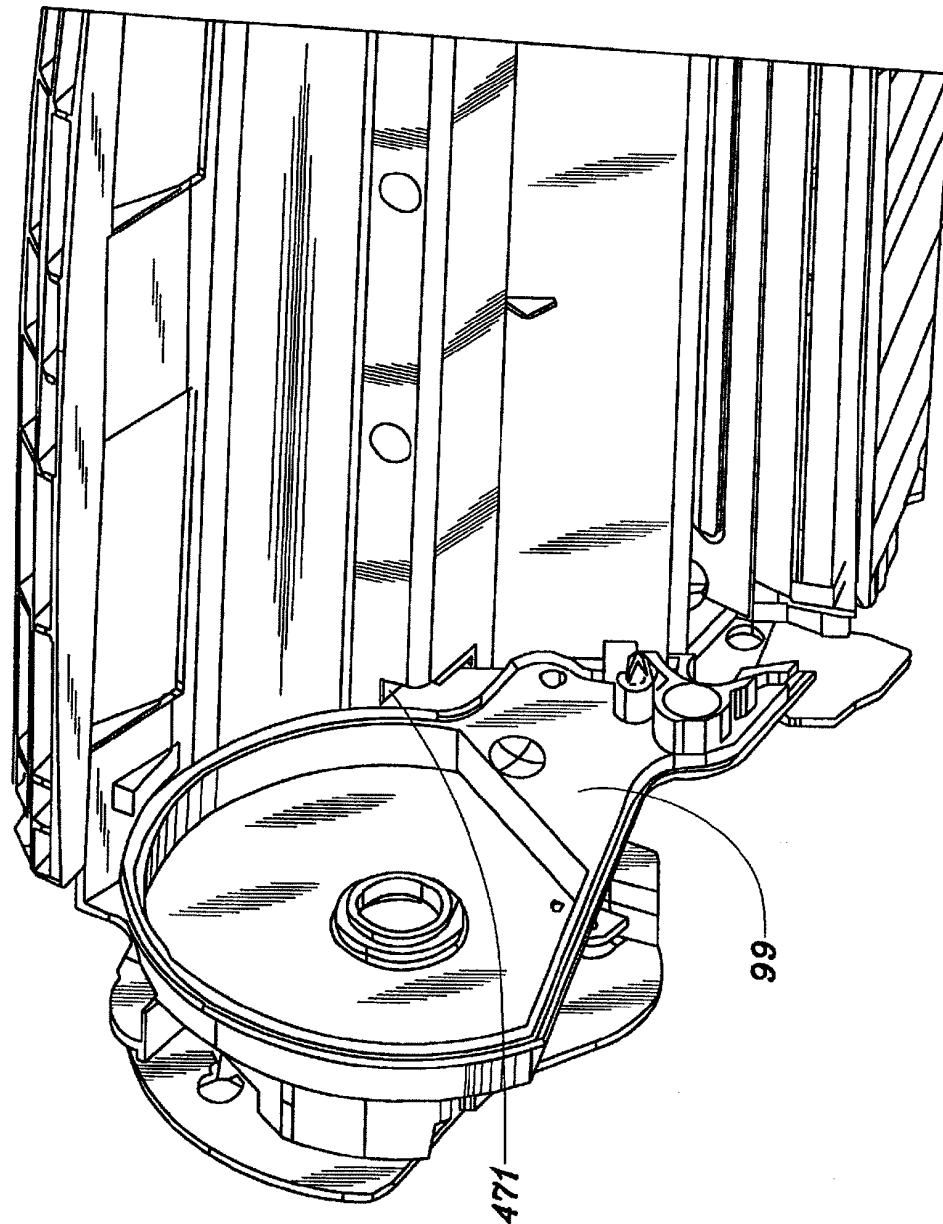
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FIG. 22



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FIG. 23

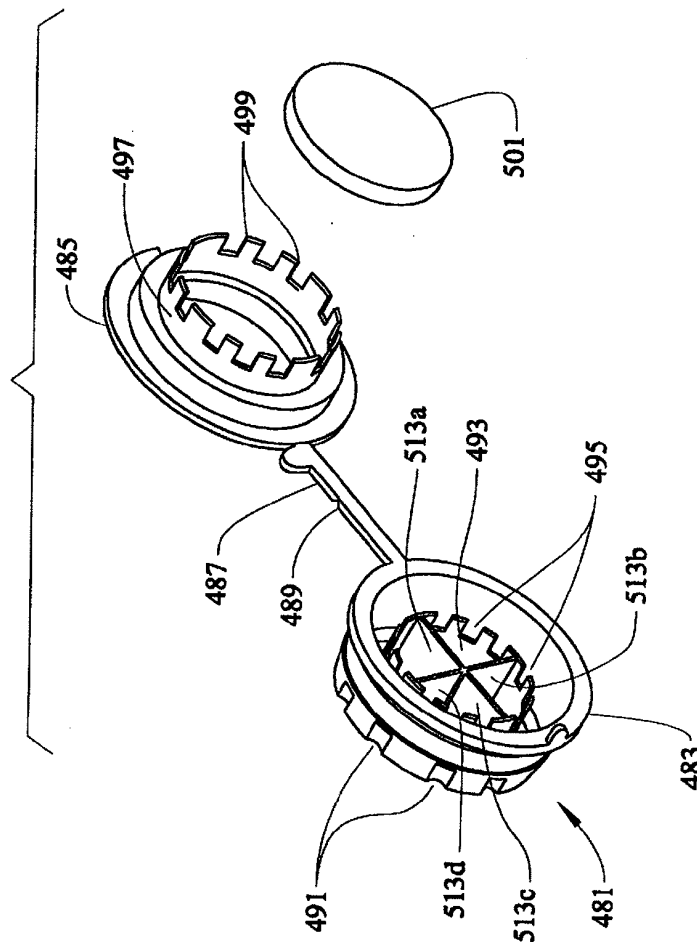
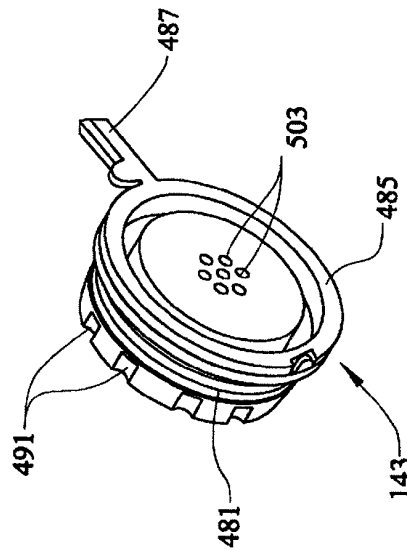


FIG. 24



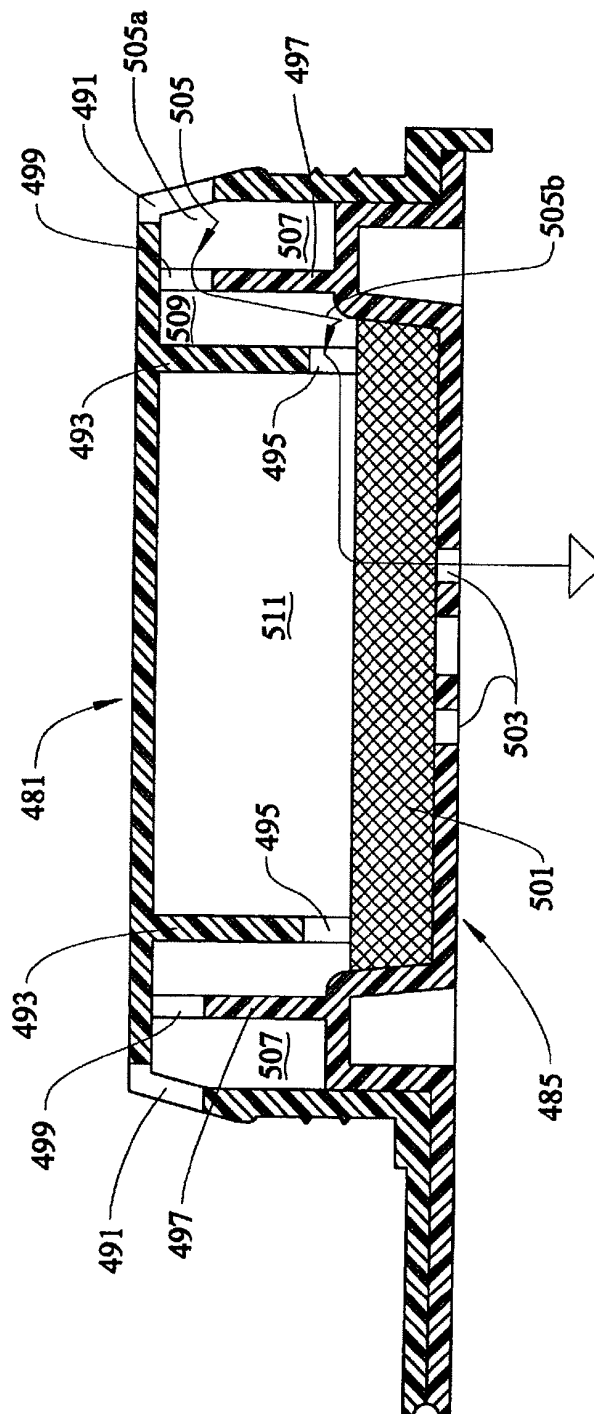
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**FIG. 25**



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## TONER CARTRIDGE WITH HOPPER EXIT AGITATOR

### CROSS-REFERENCE TO RELATED APPLICATIONS

The following United States patent applications are directed to subject matter disclosed or incorporated in the disclosure of this application Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169 entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device;" five utility applications filed the same day as this application entitled "Toner Cartridge with External Planar Installation Guides," Ser. No. 08/770,327; "Toner Cartridge with Locating on Photoconductor Shaft;" Ser. No. 08/770,326; "Toner Cartridge with Housing and Pin Construction," Ser. No. 08/770,329; "Toner Cartridge with Heat Shield Shutter," Ser. No. 08/770,334; and "Venting Plug in Toner Cartridge," Ser. No. 08/770,329; and one ornamental design application filed the same day as this application entitled "Toner Cartridge for Laser Printer, Ser. No. 29/066,775".

### TECHNICAL FIELD

This invention relates to electrophotographic development and, more particularly, relates to a toner cartridge having a barrier wall at the hopper and a declining exit surface.

### BACKGROUND OF THE INVENTION

The assignee of this invention has manufactured and sold commercially toner cartridges of two different general designs. For its larger laser printers the cartridge has contained a pump to meter toner of the kind disclosed in U.S. Pat. Nos. 5,012,289 to Aldrich et al. and 5,101,237 to Molloy, while the external structure of the cartridge is as disclosed in U.S. Pat. No. 5,136,333 to Craft et al. Details of other elements in the cartridge have varied.

For a smaller, light emitting diode printer, the cartridge is as disclosed in U.S. Pat. No. 5,337,032 to Baker et al., which has a toner hopper extending well below a level having the toner adder roller and which has independent driven systems for the photoconductor roller and for the developer roller system as disclosed in U.S. Pat. No. 5,331,378 to Baker et al.

This cartridge has a hopper exit above a vertical barrier. The outside of the barrier is a declining surface. Such a configuration is believed to be generally conventional. This invention employs an agitator operative at the exit surface, which is not believed to be in the prior art.

### DISCLOSURE OF THE INVENTION

This invention is a toner cartridge having a cylindrical toner hopper with output opening well above the lower part of the hopper. A paddle is rotated in the hopper, as is conventional. The exit surface past the opening declines downward to form a chamber having a developer roller. As is known, this configuration is desirable in that it discourages toner from returning to the hopper after it has been electrically charged in the area of the developer roller.

To facilitate movement of the toner past the opening an agitator member extends across the cartridge near the exit surface. It is pivoted at both ends to permit upward rotation and it has a portion extending past the barrier into the path of the paddle. As the paddle rotates it moves the agitator upward until the curved paths of the two members reach

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separation, at which point the agitator member drops under the action of gravity. By so dropping, the agitator member jars toner loose and eliminates jams of toner which can destroy operation.

Preferably, the agitator is a bar having an extended flat surface which faces the exit surface. The extended flat surface tends, when it has been moved fully up, to partially block the exit opening, which is also desirable for metering of the toner.

### BRIEF DESCRIPTION OF THE DRAWINGS

The details of this invention will be described in connection with the accompanying drawing, in which FIG. 1 is a perspective view of the toner cartridge from above and left rear, where left is determined facing the printer from its front side where cartridge insertion is made; FIG. 2 is a perspective view from above and left front of the cartridge sectioned near the top; FIG. 3 is a top right front view of the cartridge with further cover elements removed; FIG. 4 is a top right rear view of the cartridge with cover elements removed; FIG. 5 is a top left rear view of the cartridge with cover elements removed; FIG. 6 is a top right rear view of the cartridge sectioned similarly to the sectioning of FIG. 2; FIG. 7 is a bottom left front view of the cartridge; FIG. 8 is a bottom right rear view of the cartridge; FIG. 9 is a front right perspective view of the hopper housing member; FIG. 10 is a left front view of the inside of a printer in which cartridge 1 is installed; FIG. 11 is a partially sectioned right side view showing more detail of parts shown in FIG. 10 with the cartridge installed; FIG. 12 is a perspective view showing the inside one end member of the hopper; FIG. 13 is a perspective view showing the inside of the other end member of the hopper; FIG. 14 is a perspective view of the gear plate; FIG. 15 is a perspective view of a readily removable bushing; FIG. 16 is a perspective view showing the removable bushing installed; FIG. 17 is a right rear view showing detail of a shutter; FIG. 18 is a perspective view of an extended hub inserted in the photoconductor drum; FIG. 19 is a right perspective view showing elements inside the cover of the cartridge; FIG. 20 is a left bottom perspective view showing elements inside the cover of the cartridge; FIG. 21 is a right perspective view showing parts of the cartridge installed in a printer; and FIG. 22 shows the inside of the cover of the cartridge where it receives an extension from the hopper; FIG. 23 shows elements of the hopper plug prior to assembly; FIG. 24 shows the assembled hopper plug alone; and FIG. 25 shows a staggered cross section of the hopper plug to illustrate air flow.

### BEST MODE FOR CARRYING OUT THE INVENTION

The self-contained, removable printer cartridge 1 is shown in FIG. 1 in a perspective view from above and left rear (the hand grips 3a and 3b being considered the front and the side having the pivoted upper shutter 5 being the upper side).

For purposes of illustration, FIG. 1 shows the upper shutter 5 pivoted downward to its open position and lower shutter 7 pivoted rearward and upward to its open position. In actual operation, these positions are reached by interaction with the printer or other device in which cartridge 1 is installed as will be explained below.

To facilitate and guide insertion of cartridge 1 into the printer, cartridge 1 has a left guide wing 9a and a right guide wing 9b. Guide wings 9a and 9b are thin planes formed as arcs of a relatively large circle, except near the front, where

the bottom **9aa** is enlarged downward. Guide wings **9a** and **9b** are mirror images of each other except that, in this particular embodiment described, the left guide wing **9a** is wider (extends further laterally) than the right guide wing **9b** simply to accommodate the width provided by a particular printer in which the exemplar cartridge **1** is to be installed.

In the embodiment herein described, bottom shutter **7** is pivoted from left rear cover **31a** on a left top actuator link arm **11a** and from rear cover (not shown) on a right top actuator link arm **11b**, located on opposite sides of shutter **7**. Each link arm **11a**, and **11b** is integral with an actuator **13a**, and **13b**, respectively, each of which has a rectangular actuator surface **13aa** and **13bb**, respectively, which extends over the respective guide wings **9a**, **9b**.

A pivoted lower shutter link **15a** and a side of the lower shutter **17a**, pivoted to lower shutter link **15a** and left top actuator link arm **11a** complete a conventional four bar linkage to provide rotation of shutter **7** in response to rotation of actuator **13a**. The rear end of coil spring **19a** connects to a lower hook **11aa** in link arm **11a** to bias shutter **7** closed when the cartridge is not inserted in a printer or other device. The front end of coil spring **19a** connects to an upper hole **31aa** under actuator **13a**. A mirror image of these parts (see FIG. 3) exists on the opposite side, the corresponding part of which will be designated by the same number with "b" letters.

When cartridge **1** is installed in the printer, actuator surfaces **13aa** and **13bb** are pushed downward by the mating surfaces of the printer to the positions above wings **9a**, **9b** respectively, as shown in FIG. 1.

Cartridge **1** is inserted by a human operator grasping grips **3a**, **3b** through holes **3aa**, **3bb** and moving cartridge **1** in the direction of shutter **5** and toward the rear of the printer (**291**, FIG. 10) in which it is being installed. A series of upwardly extending ribs **21** spaced along the width of cartridge **1** under grips **3a**, **3b**, except at holes **3aa** and **3bb**, provide strength while holes **3aa** and **3bb** provide room for the fingers of a person to grasp grips **3a**, **3b**. On the left side is a relatively wide, upwardly extending tab **23**. In a preferred combination of the embodiment of the invention described herein and an exemplary printer the top of tab **23** interacts with a physical sensing switch in the printer to detect that a cartridge **1** has been installed.

Front cover **25**, on which grips **3a**, **3b**, ribs **21** and tab **23** are integrally formed, is above a separated toner hopper, as will be described. The top cover of cleaner chamber **27** is rearward of shutter **5**.

Immediately inside wings **9a** and **9b** are raised, elongated locator surfaces **29a**, **29b** to which pressure is applied by a printer to firmly position the toning mechanisms of cartridge **1** when cartridge **1** is installed. Locator surfaces **29a** and **29b**, wings **9a** and **9b**, as well as rear cover **31** under wing **9a**, are formed integral with cleaner housing **27**. Also integral with these elements is front cover **25**, having grips **3a**, **3b** and an outer cover **33** on the left side and generally coextensive in length with the length of front cover **25**. Cover **33** has a U-shaped housing **35** at its top. Housing **35** traps spacer stud **37a** as will be explained and an assembly hole **39a** near the upper front of cover **33** and a spring-holding hole **39b** near the lower front of cover **33**.

A coupler **41** receives a drive element from a printer which contains an Oldham coupler to rotatably drive the developer roller **43** (not shown in FIG. 1) and toner adder roller **45** (not shown in FIG. 1). To the rear of coupler **41** is the shaft **47** of photoconductor drum **49** (drum not shown in FIG. 1).

FIG. 2 is a perspective view from above and left front of cartridge **1** sectioned near the top to show internal elements. At the immediate front is a large, cylindrical toner hopper **61**, having a paddle **63**, which, during operation, is rotated clockwise as seen in FIG. 2. Paddle **63** has an outer toner moving bar **63a**, which extends across the width of hopper **61** except for a far left section **63aa** which is inset as will be explained. The rear wall **61a** of hopper **61** when cartridge **1** is installed for operation in a printer terminates at about one-third of the total height of hopper **61** as a flat surface **61aa** (specifically, hopper **61** has a 106 mm diameter and the distance vertically from the lowest point of hopper **61** to the horizontal plane coinciding with the highest point surface **61aa** of rear wall **61a** is 35.3 mm). The upper surface **61aa** of rear wall **61a** is thin and flat with a slight downward angle from hopper **61** to facilitate removal of the molded part from its mold. An extension **65a** from an agitator bar **65** has a depending tab **65b** (see FIG. 9) which rests on upper wall **61aa** thereby positioning agitator bar **65** slightly above upper wall **61aa**. Extension **65a** extends past upper wall **61aa** to a location at which bar **63a** of paddle **63** encounters extension **65a** as it rotates. The surface **61aaa** opposite surface **61aa** from which toner exits is flat and at approximately 50 degrees from vertical (best seen in FIG. 9) when cartridge **1** is installed for operation in a printer.

Vertical ribs **67** located immediately rearward of rear wall **61a** are stiffeners for top wall **69** formed about one-third down from the top of hopper **61**. The toner moving bar **63a** of paddle **63** is closely adjacent to the sides of hopper **61** except where the top of rear wall **61a** and the start of top wall **69** form an opening for toner to be delivered rearward from hopper **61** to the toning mechanisms of cartridge **1**. This is best shown in FIG. 9.

In FIG. 2, a small part of developer roller **43** to which coupler **41** is directly attached, is seen past ribs **67**. Developer roller **43** is parallel to and in contact with photoconductor drum **49**. Cleaner chamber **27** has spaced, vertical internal baffles **71**, which are strengthening members, as well as members which limit unbalanced accumulation of toner in chamber **27**. Toner which is not transferred during development is scraped from photoconductor drum **49** by cleaning blade **73**, which is mounted to a vertical panel **73a**, having a horizontal gusset **73aa** to increase strength. As best seen in FIG. 3, panel **73a** is mounted to supporting member **75**, which has vertical columns **75a** (FIG. 2), **75b** on opposite sides. Panel **73a** is mounted to the vertical columns **75a**, **75b** by a screw **77a** to column **75a** and a screw **77b** to column **75b**.

FIG. 3 is a top right side view with further cover elements removed and part of the cleaner removed to illustrate the internal configuration of cartridge **1**. A solid, steel-bar doctor blade **91** extends parallel with and in pressure contact with developer roller **43**. Blade **91** contacts roller **43** at about 20 degrees from the vertical toward toner adder roller **45**. Also shown in FIG. 3 are metal electrical contact **93** to doctor blade **91**, metal electrical contact **95** to toner adder roller **45** and metal electrical contact **97** to developer roller **43**. The outer ends **93a**, **95a**, **97a** of the contacts bear against metal contacts in the printer when cartridge **1** is installed and thereby make electrical contact to receive electrical potentials from the printer.

The developing system of cartridge **1** is essentially very similar to that of the Optra brand family of printers sold by the assignee of this invention. As in that family of printers, toner adder roller **45** is a conductive sponge material attached to a steel shaft and developer roller **43** is semiconductive material attached to a steel shaft. When cartridge **1**



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is installed for operation in a printer, cartridge 1 is oriented generally as shown in FIG. 3 and the horizontal plane containing the lowest surface of toner adder roller 45 is 22.6 mm above the lowest point of hopper 61.

Toner adder roller 45 and developer roller 43 are journaled in the rearward extensions 99a and 101a (FIG. 4) of the end members 99 and 101 (FIG. 4) of hopper 61. Agitator 65 has a bent portion 65aa to become parallel to extension 99a where it is pivoted to extension 99a on pin 103a. As paddle 63 rotates, bar 63a contacts extension 65a, thereby rotating agitator 65 around pin 103a upward. Agitator 65 then returns to near rear wall 61a under the force of gravity to dislodge toner, which otherwise tends to accumulate on exit surface 61aaa (see FIG. 9).

FIG. 4 is a top right rear view with cover elements removed showing more fully the end members 99 and 101 of hopper 61 and their extensions 99a and 101a. Integral with end member 101 is spacer stud 37b. Under and to the front of stud 37b is spring mounting post 131b, which mounts one end of spring 132b, the other end of which is mounted on hole 242 (best seen in FIG. 20).

Also integral with end member 101 is perpendicular shield wall 133, which extends downward and rearward to present a barrier to physically protect encoder wheel 135. The bottom portion of wall 133 forms a flat contact surface 133a to receive a locating roller from the printer when cartridge 1 is installed. Encoder wheel 135 is linked to paddle 63 through a paddle gear assembly 163 having a torsional yield member (FIG. 5) so as to provide information as to the amount of toner in hopper 61 to the printer on which cartridge 1 is installed by the sensing of the location of windows 135a. Additionally, other windows 135b provide other information, while wider window 135c provides a home location reference. Light blocking selected labels 136 are located between windows 135b and 135c and block windows of a series of windows 135b to thereby customize information onto wheel 135. The details and operation of encoder wheel 135 are described in U.S. patent application Ser. No. 08/602,648, filed Feb. 16, 1996, now U.S. Pat. No. 5,634,169 entitled "Multiple Function Encoder Wheel for Cartridges Utilized in an Electrophotographic Output Device" and form no contribution to the invention of this specification.

FIG. 4 also shows electrical contacts 93, 95 and 97 as they are supported by floor 137 which extends perpendicularly from hopper extension 101a. Vertical ribs 139 extend from floor 137 between contacts 93, 95 and 97 to strengthen the floor 137.

Mounting roller 141a is journaled to hopper extension 99a and symmetrical mounting roller 141b is mounted to hopper extension 101a. Rollers 141a and 141b contact inside surfaces of the cover of cartridge 1, as will be described. Surfaces 133a and 161a (FIG. 5) of hopper 61 rests on rollers in the printer as will be further described.

Hopper end member 101 has an opening receiving a closely-fitting, resilient, cylindrical plug 143. Prior to installing plug 143, toner is loaded into hopper 61 through the open hole, then plug 143 seals the hole.

Photoconductor roller 49 has at its right end a transfer roller drive gear 145, which drives a roller in the printer when cartridge 1 is installed in the printer.

FIG. 5 is a top left rear view with cover elements removed showing more fully the outside of members 99 and 99a of hopper 61. Integral with end member 99 is spacer stud 37a. Under and to the front of stud 37a is spring mounting post 131a, which mounts one end of spring 132a, the other end

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of which is mounted in a hole in member 431 (FIG. 19), which is an inner extension of cover 33 (FIG. 2).

Also integral with end member 99 is perpendicular shield wall 161, which extends downward and rearward to a barrier to physically protect torsional paddle gear assembly 163. The bottom portion of wall 161 forms a flat contact surface 161a to receive a locating roller from the printer when cartridge 1 is installed. The details of paddle gear assembly 163 are not part of this invention and are more fully disclosed in the above-mentioned patent application Ser. No. 08/602,648 now U.S. Pat. No. 5,634,169.

Gear 49a, integral with the end of photoconductor drum 49, receives power from a meshing gear in the printer when cartridge 1 is installed in the printer. Coupler 41 is integral with developer roller 43 and drives idler gear 165, which drives toner adder roller 45 (FIG. 3) by being meshed with gear 167, which is integral with toner adder roller 45. Coupler 41 receives power from a driver in the printer which is separate from the drive to drum 49, although preferably from a single motor in the printer.

Gear 167 drives the large gear of compound gear 169. Gear 169 drives the large gear of compound gear 171, and gear 171 drives paddle assembly gear 163. A gear plate 173, mounting gears 165 and 169, is mounted on hopper extension 99a by mounting screw 175.

FIG. 5 shows the end of agitator 65 opposite that shown in FIG. 3. That end has a bent portion 65bb to become parallel to extension 101a of end member 101 when it is pivoted to extension 101a on a pin 103b.

Continuing the detailed description of the cartridge incorporating a preferred embodiment of the present invention, FIG. 6 is a top right rear view sectioned near the top similar to the sectioning of FIG. 2. FIG. 6 illustrates more clearly the mounting of doctor blade 91 mounted to press on developer roller 43 under the bias of leaf spring 191. Blade 91 is located on the left rear by tab 361 (best seen in FIG. 14), and on the rear by extension 196a (FIG. 12) of hopper end member 99 which form front and back barriers for holding the left side of doctor blade 91. Similarly, on the right side, two surfaces extending from extension 101a, including a rear extension 365 (best seen in FIG. 13) and a front extension 366 (FIG. 13) form front and back holding the right side of doctor blade 91, symmetric to the cage holding the left side of doctor blade 91. The top of blade 91 is held by spring 191. An adhesive tape 192 across the top of the doctor blade 91 bridges over the adjoining horizontal edge of wall 69 (FIG. 2) for sealing, as is conventional.

Spring 191 has blunt ends 191a and 191b, spaced from the center, which contact blade 91 to bias it downward on to developer roller 43. A central ledge 197, integral with ribs 67, forms a cavity receiving the center of spring 191. Horizontal ledges 199a and 199b, opposite central parts of spring 191, formed integral with ribs 67, are horizontal barriers to prevent spring 191 from moving toward the front. Preferably, so as to permit rough handling of cartridge 1 which might occur during shipment, solid upper stop members (not shown) are attached by double sided adhesive on each side between ledges 199a and 199b and the sides 99a and 101a, respectively. These are spaced 0.18 mm above the top of blade 91 and, therefore, contact blade 91 only during rough handling.

FIG. 6 also illustrates posts 141aa and 141bb, which are molded as extensions of members 99a and 101a, respectively, and supporting mounting rollers 141a and 141b, respectively (FIG. 5).

FIG. 7 is a bottom left front depiction of cartridge 1 viewed externally. A series of horizontal depressions 221



along the back of hopper 61 provide a roughened surface for thumbs when fingers grasp the cartridge through opening 3aa and 3bb. A series of relatively long vertical ribs 223 integral with the bottom of hopper 61 serve as paper and other media guides, while a series of shorter ribs 225, located rearward of the start of ribs 223 and between ribs 223, prevent media snags as media encounter photoconductor drum 49, located immediately after ribs 223 and 225. Past drum 49, media encounter further media guide ribs 227 located on the bottom of shutter 7. FIG. 7 also affords a clear view of idler gear 165 and gear 167.

FIG. 8 is a bottom right rear depiction of cartridge 1 viewed externally. This shows the full right guide wing 9b with enlarged front part 9bb. FIG. 8 shows the right cover elements which were deleted in FIG. 6. A front lower cover section 241 is over much of the encoder wheel 135 and has an access hole 243 for ease of assembly and has an access opening 244 (best seen in FIG. 20). Cover section 241 is stepped outward a small amount to provide room for spring 132b (FIG. 20) to extend between post 131b (FIG. 4) and hole 242 (best seen in FIG. 20). Generally, above and forward of and integral with cover section 241 is cover section 245, which is over the remaining upper front of cartridge 1. Section 245 has a U-shaped housing 247 at its top which traps spacer stud 37b. In the rearward part of section 245 opposite the area above photoconductor drum 49, are located rectangular channels 249 with the second rectangular channel 249a and the last rectangular channel 249b being open to pass air for cooling photoconductor drum 49 during operation of cartridge 1.

The far rear portion 251 of this particular embodiment of the invention herein described mounts links 11b and 17b to shutter 7. A bottom section 253 of the cover located under and forward of passages 249a and 249b mounts the shaft 47 of photoconductor drum 49 and has two upper symmetrical vent holes 255a and 255b to pass air for cooling drum 49.

FIG. 9 is a front right perspective view of the molded plastic member housing 271 which forms the central portion and central extension of hopper 61 with end member 99 attached and agitator 65 installed. It is seen to form a cylindrical chamber with an exit opening formed between wall 69 and wall 61a. An inset 273 at the bottom rear of hopper 61 provides space for rollers in the printer. As best seen in FIG. 2, paddle bar 63a has an inset for left section 63aa to clear inset 273.

Member 271 has a slot 275 around its right side. A directly similar slot is around the left side. End member 101 has a mating ridge 321 (FIG. 13). During manufacture slot 275 is mated with ridge 321 in end member 101 and the two are welded together with ultrasonically created heat. Member 99 is welded to the left side of member 271 in the same manner with ridge 322 (FIG. 12) inserted in a mating slot (not shown) on the left side of member 271.

A notch 277 above agitator extension 65a allows for sufficient rotation of agitator 65 to allow paddle arm 63a to pass beyond extension 65a while preventing a full turn-over of agitator 65.

#### Developer Assembly

The housing 271 and its attached end members 99 and 101, form toner hopper 61. Extension 101a journals toner adder roller 45 and developer roller 43. Gear plate 173, which is attached to extension 99a by screw 175, journals the opposite ends of toner adder roller 45 and developer roller 43. Accordingly, a single unitary assembly is formed of the hopper 61 rearward to and including developer roller 43.

#### Photoconductor and Cover Assembly

Front cover 25 grips 3a, 3b, left outer cover 33, rear wall 31, (FIG. 1) right cover sections 241, 245, and 251, (FIG. 8) wings 9a, 9b and cleaning chamber 27 are a single molded part. Photoconductor 49 is journaled in this part with its shaft 47 extending past the covers on opposite sides. Shutter 7 is movably supported to left cover 31 and right rear cover 251. Accordingly, a single unitary assembly is formed of the cover members, the photoconductor drum 49 and the shutter 7.

In use, springs 132a and 132b pull the developer roller 43 against the photoconductor drum 49 at a predetermined tension. When cartridge 1 is picked up, the developer assembly and the photoconductor and cover assembly rotate under gravity until stud 37a (FIG. 1) contacts housing 35 and stud 37b (FIG. 8) contacts housing 247, thereby holding the two assemblies together.

#### Lower Shutter as Heat Barrier

Lower shutter 7, when open, covers all of the lower surface of the cleaner chamber. The material of shutter 7 is polycarbonate, a material which deflects heat from the fixing operation which occurs after paper is moved rearward from contact with the photoconductive drum 49. The material of the body of the photoconductor and cover assembly, the hopper 61, end members 99 and 101, and shutter 5 are polystyrene which is lower in cost than polycarbonate would be. The added cost of shutter 7 being polycarbonate is justified by shutter 7 providing heat protection to the cleaner 27 which allows that member to be polystyrene.

#### Agitator Bar System

The toner of cartridge 1 is monocomponent, which can become stagnant and cohesive when left undisturbed for a time. This stagnation and settling of toner may be aggravated by the slight vibrations generated by the printer motor and gear train in a laser printer.

Failure to deliver toner from wall 61a via sloped exit surface 61aaa is the consequence of the settling, stagnation, and cohesive nature of the monocomponent toner in hopper 61. The angle of repose of the settled toner (i.e., the angle of tilt of a surface on which the settled toner rests before it "falls" under its own weight) can reach or exceed 90 degrees. The exiting surface 61aaa is tilted upward at approximately 50 degrees from vertical during operation (angle A, FIG. 9), allowing the toner to stagnate into a pile that does not reach the toner adder roller 45. This leads to premature failure to print, termed "starvation," as would result using an empty cartridge. Experimentally, as much as 230 grams of the 465 gram capacity of hopper 61 of toner have been found in the hopper 61 of a cartridge 1 when starvation has occurred due to existence of a stagnant pile of toner preventing toner delivery to toner adder roller 45.

Agitator bar 65 overcomes toner stagnation and failure to deliver toner to toner adder roller 45. The primary function of agitator bar 65 is to prevent toner stagnation and to deliver toner from the entrance of the developer sump to the toner adder roller thus preventing premature failure to print.

As the hopper paddle 63 rotates counter-clockwise (FIG. 3), it reaches a point in its rotation where it begins to contact extension 65a and lift agitator bar 65. Paddle 63 continues to lift agitator bar 65 until it loses engagement with extension 65a. At this point, the agitator bar 65 falls back via gravity to the resting position, carrying toner from the entry of the developer chamber to the toner adder roller. (Although

not useful on the disclosed embodiment, an alternative is a pad on extension 65a or on upper wall 61aa which will cushion the fall. Such a pad would also serve as a spacer to control the position of the agitator in the down position and eliminate tab 65b).

At the top of its travel the agitator bar 65 is out of the way of the main sump paddle 63 and approaches a notch 277 in the hopper housing 271 (FIG. 9). Notch 277 provides space for the agitator bar 65 to clear the end of hopper paddle 63, and prevents overtravel of the agitator arm 65, which could cause locking into an up position when the cartridge is shipped, stored, or handled outside of the machine.

In the up position, the agitator bar 65 forms a nearly vertical wall over hopper wall 61a. The initial opening above wall 61a is about 26.7 mm, while the height of bar 65 facing that opening is 7 mm. This allows room for toner from the main sump to flow between the agitator 65 and sloped wall 61aaa. It also serves as a temporary barrier to prevent the delivery of excessive amounts of toner from the hopper 61 to the toner adder roller 45. As the agitator bar 65 falls to its resting position, both newly delivered toner and any stagnant toner resting on wall 61aaa are pushed toward the toner adder roll 45. The motion of the agitator 65 also stirs toner in the area above and toward developer roll to doctor blade nip 91, helping to prevent packing and stagnation of toner in this volume.

The agitator 65, preferably can be implemented by stamping (or laser cutting) and can be formed from sheet metal with spring characteristics that maintain agitator shape during assembly and operation. The entire part comprising bar 65, extension 65a and bent portions 65aa and 65bb preferably can be made by stamping out all features in one operation. As envisioned for the preferred embodiment, illustrated herein, bar 65 may have a length approximately equal to the toner adder roller length, which may be, for example, 220 mm; and have an exemplary height of approximately 7 mm; a thickness of 1.3 mm, chosen to give an agitator mass of the entire part stamped of, for example, approximately 20 grams. Since agitator bar 65 is driven by gravity, the mass is chosen to provide a driving force sufficient to push stagnant toner along wall 61aaa to toner adding roll 45, but the mass is limited so as not to affect the torque sensing function of the hopper paddle 63.

Hinge segments 65aa and 65bb and the associated distance from pins 103a and 103b to agitator bar 65 determine the arc swept by bar 65 as it falls from the up position to the down position. In the present preferred embodiment, pivot distance of 13.5 mm, for example, allows the paddle to sweep from an up position which leaves a gap of 3 mm between the bottom of the bar 65 and the wall 61aa, to a down position 3 mm above the toner adder roller 45. With this design, the weight of the paddle is effectively applied to move toner over the distance swept by the arc. A shorter pivot distance would result in insufficient travel to capture and deliver toner; and would require a heavier paddle to exert the same force on the toner over the distance swept through the arc. Pins 103a and 103b are smaller in diameter (1 mm, for example) than their holes in which they fit in portions 65aa and 65bb to prevent binding due to toner buildup.

Extension 65a is long enough to engage the active segment of paddle 63. Additionally, the length of extension 65a is long enough to overlap the active segment of paddle 63 when extension 65a first engages the paddle 63 to prevent scraping of the paddle surface. A small radius (0.5 mm, for example) is placed on the bottom tip of extension 65a to prevent scraping of paddle 63 as it releases extension 65a.

The overall length and elasticity of the agitator 65 allows assembly over pins 103a and 103b by simply deflecting the part.

Accordingly, this agitator design functions to overcome toner stagnation and to deliver toner from the entry of the hopper 61 to the toner adder roller 45 active area. The agitator 65 and its extensions 65a, 65aa and 65bb are a single part. Agitator bar 65 is driven internally, with no external gearing, cams, or seals as would be required by an externally driven agitator. Thus gear cost and complexity, seals, friction, and toner leaks are eliminated as problem areas. Agitator 65 is activated frequently enough to move toner and prevent stagnation without adding excessive stirring or damage to the toner. This design enhances first-in, first-out toner delivery from hopper 61 to the smaller area containing the toner adder roller 45 by preventing excessive toner delivery in the raised position and discouraging return toner from the area of the toner adder roller 45 to the hopper 61.

### Dimensions

With the cartridge installed for operation, the location of the nip of toner adder roller 45 with developer roller 43 is at 105 degrees from vertical. The nip angle of the photoconductor drum 49 to the developer roller 43 is 95 degrees from vertical. As previously stated, the doctor blade nip is at 20 degrees from the vertical.

The length from the bottom of hopper 61 to the horizontal plane coinciding with the edge of top surface 69 near hopper 61 is 61.96 mm, creating an initial opening of about 26.7 mm (as indicated previously, bottom surface 61aa is at 35.3 mm). Top surface 69 has a slight upward angle to a tallest point of 64.34 mm.

The diameter of toner adder roller 45 is 14 mm and it is located with its circumference 1 mm above the bottom of hopper body 271 immediately below it. The diameter of developer roller 43 is 20.11 mm and it is located with its circumference 2 mm above the bottom of hopper body 271 immediately below it. The length from the bottom of hopper 61 to the horizontal plane coinciding with the bottom of developer roller 43 is 23.7 mm, and the corresponding length to the bottom of the toner adder roller 45 is 22.6 mm. The diameter of photoconductor drum 49 is 30 mm.

The bottom of body 271 under rollers 43 and 45 is at a 6 degree upward angle to provide sufficient room for guide ribs 225 on the outside of body 271.

### Installing the Cartridge

FIG. 10 is a left front view of the inside of a printer with which the inventive cartridge herein described by way of an exemplary preferred embodiment may be used. The cartridge 1 is installed in a printer 291 (FIG. 10) from the front to a final position well within the printer 291. To achieve this, guide wings 9a and 9b are initially guided by a lower track 293 over a curved track, which guides cartridge 1 under the laser printhead (not shown) and over paper feed elements 295.

The path is downward, which utilizes gravity while inserting cartridge 1, thereby easing insertion. The guide 293 (and a guide not shown, which is a mirror image of guide 293 on the opposite side of printer 291) has the same curvature as wings 9a, 9b so that the wings 9a, 9b can follow guide 293 and its opposite guide.

Upper guide 297 is parallel to guide 293. Guide 297 extends further into the printer than guide 293. A guide (not

shown), which is a mirror image of guide 297, is on the opposite side of printer 291. Guide 297 encounters actuator surface 13bb early during the insertion of cartridge 1. As cartridge 1 is moved rearward, actuator surface 13bb is rotated to open shutter 7 (as is surface 13aa rotated by encountering a mirror image of guide 297 on the left side of the printer). This early movement of shutter 7 is very advantageous in that it eliminates the need for space and mechanism which would be required if actuation occurred at the end of insertion of cartridge 1.

Also shown in FIG. 10 is the right reference position roller 299 on which contact surface 133a rests when the cartridge is inserted. Contact surface 161a will rest on an identical roller (not shown) on the opposite side of printer 291. Rearward of roller 299 is V-block 301, shown more clearly in FIG. 11, and an associated electrical contact 302. Further rearward is an upstanding lug 303, which will contact shutter 7 to hold it open as will be described.

As cartridge 1 is inserted, wings 9a, 9b are guided by guides 293 and 297 and the mirror image guide (not shown) on the opposite side of printer 291. As insertion continues, the wings 9a, 9b fall off the lower guide 293 (and its mirror image guide) and the shaft 47 of photoconductor drum 49 drops into V-block 301 and a mirror image V-block (not shown) on the opposite side of printer 291. A depending thin metal sheet 302 (FIG. 11, shown in side view) is contacted and bent somewhat by shaft 47 as it is guided by V-block 301. This creates a connection for operating potential to shaft 47. When cartridge 1 falls into V-block 301, lug 303 contacts shutter 7 to hold shutter 7 open. Prior to that the longer length of upper guide 297 was sufficient to hold shutter 7 open.

In this final position cartridge 1 is more precisely located with respect to functional elements. Cartridge 1 is held in printer 291 as described below under the heading "Reference Surfaces."

To remove the cartridge, it is grasped by grips 3a, 3b and pulled sharply upward and forward. Wings 9a and 9b again enter between guides 293 and 297, and the cartridge can be pulled free.

#### Manufacture of Cartridge

All molded parts follow the technical dictate (to avoid distortion on cooling) of keeping adjoining surfaces the same thickness. Accordingly, molded studs seen from the rear (shown, for example, in FIG. 13) appear as holes in the part. Circles in the drawings with bowed lines crossing indicate the gate where molten resin was received into the mold (shown, for example, also in FIG. 13).

Assembly of cartridge 1 begins with the joining of hopper body 271 to its end members 99 and 101 with paddle 63 installed. The inside of end member 99 is shown in FIG. 12 and the inside of member 101 is shown in FIG. 13. Both are molded parts of polystyrene resin. Each of the members 99 and 101 is mated to its corresponding side of body 271 (FIG. 9). Ridge 321 of member 101 enters slot 275 on the right edge of member 271. Ridge 322 of member 99 enters slot (not shown) on the left edge of member 271 mating ridge 322. Those parts are held tightly in a fixture and ultrasonically welded, with paddle 63 inserted before the last of the two end members is welded. Then a bushing (not shown) is press fit into the central hole 325 of member 101 around the shaft of paddle 63 and a second bushing (not shown) is similarly press fit around the shaft of paddle 63 in central hole 329.

Agitator bar 65 (FIG. 9) is then flexed and installed by mounting end portion 65aa on pin 103a and end portion 65bb on pin 103b.

Toner adder roller 45 with low friction washers on each end is then installed by angling its shaft through hole 333 (FIG. 12) in member 99, straightening, and then moving roller 45 laterally to bring its shaft through a press fit bushing (not shown) in socket 335 in member 101.

Prior to installing toner adder roller 45 and gear plate 173, a sickle-shaped seal member having a semicircular central body (not shown) is installed on each side of the location of developer roller 43. Such a seal is illustrated in IBM Technical Disclosure Bulletin, Vol. 33, No. 3B, Aug. 1990, pp. 29-30, entitled "Toner Seal for Printer." The location of this seal on the right side is labeled surface 383 in FIG. 13. This is essentially standard as putty is first applied on each end of the location for the seal and the ends of the compliant elongated seal are pressed into the putty. The seal has ridges directed slightly toward the center. A seal system such as this is essentially the same as previous cartridges.

Doctor blade 91 (best seen in FIG. 6) is then installed by bringing it vertically upward behind ridge 365 (FIG. 13) on the right. In the completed cartridge 1 blade 91 is held on the bottom by contact with developer roller 43. Developer roller 43 with low friction washers on each end is installed by positioning the left end of its shaft past end member 99 (FIG. 12) and threading the right end of its shaft through the central hole of the bushing 375, shown in FIG. 15.

Gear plate 173 is shown alone in FIG. 14. It has a hole 351 to receive the shaft of toner adder roller 45 and hole 359 for shaft of developer roller 43. A central hole 353 is to receive screw 175 but hole 353 is significantly larger than the shaft of screw 175. Gear plate 173 has a shaft 355, a shaft 357, and a rightwardly extending tab 361.

Gear plate 173 is brought toward member 99 while the shafts of toner adder roller 45 and developer roller 43 are positioned through holes 351 and hole 359 respectively. Gear plate 173 is rotated until tab 361 abuts the edge of doctor blade 91. This serves as a locator for gear plate 173 and doctor blade 91. Screw 175 is then tightened in hole 353 to fix plate 173 in that position.

Gears 169, 165 and 171 are pressed on shafts 355, 357 and 363 (FIG. 5, on member 99). (As is shown in FIG. 14, such shafts have an enlarged head with a gap so as to be yieldable when receiving a press-on force.) A gear 167 is also pressed on the shaft of toner adder roller 45. Paddle gear assembly 163 is pressed onto the shaft of paddle 63. These gears and drive coupler 41 are keyed to their shafts by the two having matching "D" cross sections.

Bushing 375 has a flat outside segment 377 which permits bushing 375 to enter opening 379 (FIG. 13) in member 101 since opening 379 is circular with an open less-than-one-half circle segment in which bushing 375 can fit at one orientation. Bushing 375 is then rotated in a direction to rotate lower tab 381 downward, which removes the orientation at which bushing 375 can fit through the incomplete segment of 379 and locks bushing 375 into place. Bushing 375 installed is shown in FIG. 16. In operation, developer roller 43 rotates in a direction to rotate tab 381 downward. The advantage of bushing 375 is that it provides for relatively easy installation and change of developer roller 43 in the event that a member requires replacement during subsequent tests.

Drive coupler 41 is then press fit on the left end of the shaft of developer roller 43 using a locating shim to space coupler 41 slightly from cover 31. Mounting rollers 141a and 141b are previously applied by press fit during completion of the hopper 61. An adhesive tape is applied across the top of doctor blade 91. Spring 191 is then flexed into place



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to bias doctor blade **91** downward. After toner is installed and leak tested, the previously mentioned upper stop members on each side of ledges **199a** and **199b** are applied individually and remain in place, held by their back adhesive layer. Also encoder wheel **135** is installed by press fit.

With rollers **43** and **45** and doctor blade **91** in place, metal contact **93** is inserted between ribs **139**. Contact **93** has arrowhead sides to bind into ribs **139**, and extends upward and over two posts **385** (FIG. 4) in member **101a** and extends to a bent end which presses against doctor blade **91**. Contacts **95** and **97** similarly have arrowhead sides which dig into ribs **139** and terminate in short bent ends **387**, **389**, respectively, which press against the shafts of roller **45** and **43**, respectively. Contact grease is added to contacts and shafts.

The foregoing all are part of the developer assembly. The photoconductor and cover assembly is separately assembled. The cleaner blade panel **73a** (see FIG. 3) is installed using screws **77a** and **77b**. Link arms **11a**, **11b**, **17a**, **17b** and **15a**, **15b** are assembled in a known manner by studs having extensions which enter matching holes in adjoining arms. The arms then are rotated to operating positions in which the extensions find no opening and therefore lock the members together while leaving them free to rotate. Links **13a** to **11a** and **13b** to **11b** are held by a pin **401** with latch, as shown in FIG. 17.

Pin **401** has a circular flexible arm **403** and arms **11a** and **11b** have a matching ledge **405b** (the ledge in the opposite side not shown). Pin **401** is inserted through the holes of member **13a** and **11a** and another pin **401** is inserted through the holes of members **13b** and **11b**. The pins **401** are then rotated until their arms **403** flex around ledge **405b**, and the ledge on the opposite side respectively, and then recover to latch under ledge **405b**, and the ledge on the opposite side, respectively. This holds both four bar linkages in place. Pin **401** has a shaft **407** (best seen in FIG. 4), which extends into a groove (not shown) on each side of cleaner **27** for added stability of each four bar linkage.

Shutter **7** is installed by flexing shutter **7** and locating pin **431b** and a pin on the opposite side (not shown) on opposite sides and inserting pin **431b** and the pin on the opposite side in holes in the sides of locator surface **29a**, **29b**, respectively. Pin **431b** has a coil compression spring **433** wrapped around it which is tensioned to bias cover **7** upward.

As best seen in FIG. 19, one end of spring **132a** is attached through a hole of connector tab **431** of cover **33** on one side and the opposite end of spring **132a** is temporarily attached to hole **39a** of cover **33**. As seen in FIG. 20, spring **132b** is attached through a hole of connector tab **242** of cover **241** on one side and the opposite end of spring **132b** is temporarily attached to hole **243** of cover **241**.

The photoconductor drum **49** is installed into the cleaner housing assembly by placing the drum and the two gears **49a** and **145** (see FIGS. 4 and 5) in position with a thin washer, (not shown) on the left side and inserting shaft **47** through that assembly and the housings **31** (FIG. 2) and **253** (FIG. 8). Standard E-clips are installed on each end of shaft **47** to hold the drum and shaft from lateral movement. As shown in FIG. 18, an extending hub **145a** of gear **145**, has an internal copper sheet **421** with three sharp points **421a**. Copper sheet **421** also has an elongated member **421b** extending to over the central hole. Hub **145a** is inserted inside drum **49**. Points **421a** dig into the aluminum cylinder which forms the inside of drum **49**, creating both physical and electrical connection. Shaft **47** is then threaded through gear **145**, drum **49** and then through gear **49a**. This bends elongated member **421b** so that it presses against shaft **47** and makes electrical contact.

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The developer assembly is then placed before the photoconductor and cover assembly and the two are moved together. Covers **33** and **241**, **245** flex outward and then close into the final position. Springs **132a** and **132b** are removed from holes **39a** and **243** and manually attached to studs **131a** and **131b** respectively. This completes the cartridge **1**.

It will be readily understood that any joint where toner is contained must be sealed. Immediately inside the bearings of toner paddle **63** and toner adder roller **45** synthetic rubber end seals are located. FIG. 13 shows a socket **335** having upper and lower tabs which receive such a seal, the seal having matching extensions which fit in the tabs to prevent rotation of the seal. The ends of the chamber of cleaner **27** have foam walls with outer adhesive to secure their positioning. As is previously known, other extended joints have a plastic (polyethylene terephthalate) tape with one side carrying pressure sensitive adhesive applied along them by the adhesive. As is also previously known, developer roller **43** is sealed with a tape which is cantilevered up from the bottom of body **271** to be located in front of the roller **43**. A second adhesive strip seals the far rear edge of body **271**. Such sealing is basically standard and forms no part of this invention.

#### Toner

In a preferred embodiment cartridge **1** employs mono-component electrophotographic toner which may be basically conventional. The amount of toner in hopper **61** is limited by pressure impairing print quality and sensing of toner level by toner resistance on paddle **63**. When cartridge **1** is in the installed position, a typical top level of toner will be 10 mm above the upper barrier wall **61aa**. The presence of toner at that typical highest level is indicated in FIG. 9 by surface lines of toner **425**, but the toner is shown otherwise as transparent for clarity. The actual toner is, of course, an opaque, dry powder. During use, the toner is depleted to lower levels and it is moved by paddle **63**. As is conventional, developer roller **43** applies toner **425** to photoconductor drum **49** to develop electrostatic images on photoconductor drum **49**.

#### Reference Surfaces

FIG. 19 shows just the roller **141a** of the hopper assembly as finally installed and, therefore, located on a flat surface **441** which is an extension of the cover **33**. Similarly, FIG. 20 shows just the roller **141b** of the hopper assembly as finally installed and therefore located on a flat surface **443** which is an extension of cover **241**. Such positioning of an assembly with the photoconductor roller and an assembly with the developer roller for lateral adjustment for rollers is essentially the same as in prior cartridges.

However, in the described embodiment of the present cartridge, cartridge **1** has flat surfaces **133a** and **161a** and the printer **291** has the second set of rollers (roller **299**, FIG. 10 and its mirror image), on which flat surfaces **133a** and **161a**, respectively, rest. In the prior cartridges a second set of rollers was part of the cartridge. As in the prior cartridges the two sets of rollers **141a**, **141b**, **299**, and the mirror roller image of **299**, define a plane of movement to guide the developer roller **43** into the intended contact with photoconductor drum **49**.

FIG. 19 shows tab **23**, which is an extension of cover **33** and, when the cartridge **1** is installed in a printer as shown in FIG. 19, is generally above a flat surface **445** of the frame of the printer. Similarly, as shown in FIG. 20, a top flat ledge **447** is an extension of cover **241** and, when cartridge **1** is

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installed in a printer, is above a flat surface (448 of FIG. 10) of the frame of the printer.

A flat bottom surface 449 (FIG. 19) is under tab 23 of cover 33, and a flat bottom surface 451 (FIG. 20) of cover 245 is under ledge 447. Bottom surfaces 449 and 451 are locator surfaces which rest on frame surfaces 445 and 448, respectively.

FIG. 21 shows the right side of cartridge 1 installed in a printer with emphasis on cantilevered roller 461 pressing down on locator surface 29b. A second cantilevered roller (not shown), which is a mirror image of roller 461 exists and presses down on locator surface 29a. Roller 461 and its mirror image roller are attached to the frame of the printer. They are firmly biased downward by a coil spring 463 for roller 461 and a mirror image coil spring for the mirror image roller. As the cartridge 1 is inserted in the printer by movement of wing 9a in guides 293, 297 and wing 9b in corresponding mirror image guides, locator surface 29b encounters cantilevered roller 461 and locator surface 29a encounters a corresponding mirror image cantilevered roller; and the locator surfaces 29a, 29b rotate those rollers upward as the cartridge 1 continues to move.

When wing 9a falls off of guide 293 and is finally positioned by shaft 47 settling in V-block 301, cantilevered roller 461 fully contacts surface 29b, as shown in FIG. 21. When the top cover of the printer is closed, a downwardly positioned leaf spring on the printer cover contacts tab 23 on the left front of cover 33 and a second downwardly positioned spring on the printer cover contacts surface 447 on right cover 241. Such interaction of a cartridge with a printer lid is generally conventional, as illustrated by U.S. Pat. No. 5,365,315 to Baker et al.

As the printer lid is closed, a charge roller mechanism is moved to shutter 5 and then continues to move downward to open shutter 5 by pushing it downward and to bring a charge roller in contact with photoconductor drum 49. A laser beam for discharging drum 49 is also directed through the opening left after shutter 5 is pivoted down, as is shown on U.S. Pat. No. 5,526,097 to Ream.

In summary, the photoconductor and cover assembly is located downwardly by front surfaces 449 and 451, is located downwardly by shaft 47 in V-block 301 and in the mirror image V-block and is held in the downward location by cantilevered roller 461 on surface 29b and the mirror image cantilevered roller on surface 29a. The developer assembly is located laterally by springs 132a and 132b moving the assembly so that developer roller 43 contacts the photoconductor drum 49, and is located downwardly by ledge 133a resting on roller 299 and ledge 161a resting on the mirror image roller to roller 299. The developer assembly requires no upward locator as it has sufficient weight not to displace upward.

Ledges 133a and 161a resting on roller 299 and a mirror image roller respectively permit the developer assembly to adjust laterally. In prior cartridges, both sets of rollers were in tracks in the cartridge. This required difficult tolerances to locate the bottom of the cartridge within the printer. In the subject cartridge, ledges 133a and 161a have no linked parts to the media guide ribs 223 and 225, which are in the same molded part as ledges 133a and 161a.

FIG. 22 shows an extension of side member 99 held in a slot 471 in the bottom of the cover 25. This provides lateral location between the hopper assembly and the cover 25. Generally similar lateral location structure is provided in previous cartridges. If desirable, the upper parts of end members 99 and 101 may have an upward ridge or bump,

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which will strike cover 25 during rough handling and thereby limit relative upward movement of the hopper assembly with respect to cover 25.

When installed in the printer, frame members contact left cover 31 and right cover 241 to assure they do not contact the hopper assembly and interfere with its free movement over roller 299 and its mirror image roller on ledges 133a and 161a respectively.

#### Venting by Plug

Plug 143 (FIG. 24) in a preferred form is a venting element which allows air to escape cartridge 1 while blocking toner. Cartridge 1 in the embodiment disclosed is designed to operate at high speed to print from 8 to 24 or more standard pages per minute. This operation generates a potentially detrimental internal pressure level during operation, which contributes to leaks of toner from cartridge 1. To relieve such pressure, plug 143 is a labyrinth design ending in a felt filter.

The leaks often, but not exclusively, occur immediately after the cartridge becomes inactive. Internal pressure in hopper 61 is created by ingesting air with toner 425 carried by the developer roller 43 past a seal (not shown) under the developer roller 43. The toner adder roller 45 pulls this air/toner mixture away from the developer roller which creates a pressure increase in hopper 61 until an equilibrium pressure is reached. As shown in FIG. 23, plug 143 is formed from a single molded part 481 having a circular base member 483 and a circular cap member 485 separated by a thin connecting arm 487, which has a central notch 489 to permit bending as a solid hinge.

Base 483 has a series of equally separated external holes 491 around the entire bottom circumference of base 483. Extending from the bottom of base 483 and located inward is a circular wall 493 having spaced rectangular openings 495 at the outer end of wall 493 equally spaced around the entire circumference of wall 493.

Similarly, cap 485 has a circular wall 497 extending from the top of cap 485 having spaced rectangular openings 499 at the outer end of wall 497 equally spaced around the entire circumference of wall 497. A disk 501 of standard F3 felt is pressed into the center of cap 485 where it contacts the inside of holes 503 (FIG. 24) in the center of cap 485.

To complete plug 143 as shown in FIG. 24, cap 485 and base 483 are intermeshed by folding arm 487 at hinge point 489. In this position no part of openings 499 is opposite external holes 491 and no part of openings 495 is opposite holes 499. FIG. 25 is a staggered cross section view of FIG. 24 which shows all of the openings 495 and 499 and indicates the staggered path by the angles 505a and 505b in discussion arrow 505.

As shown in FIG. 25, the plug is held together by a press fit in which the bottom circumference of base 483 is slightly smaller than the circumference of cap 485. In operation, when pressure increases in cartridge 1, air, potentially containing toner particles, enters holes 491 which are inside of hopper 61. That air enters circular chamber 507, as illustrated by arrow 505, and is blocked by wall 497 immediately opposite hole 491 and, therefore, must move right or left, as illustrated by bent arrow 505a, to reach openings 499. The air then enters chamber 509. That air is blocked by wall 493 and also must move right or left, as illustrated by bent arrow 505b, to reach openings 495, which are on the opposite end of chamber 509. Upon passing through openings 495, as shown by arrow 505, the air enters central chamber 511 and passes through felt filter 501 and then out of cartridge 1

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through holes 503. (FIG. 23 shows four central flanges 513a-513d, which divide chamber 511 into four equal parts. However, flanges 513a-513d are for structural support of felt disk 501 and, functionally, chamber 511 can be a single chamber.)

The labyrinth configuration of this construction of plug 143 results in continuing operation as an air vent with only minor accumulation of toner inside of the plug 143. The internal chambers 507, 509 and 511 are concentric circles.

We claim:

1. A toner cartridge comprising a cylindrical hopper having an opening for delivering toner out of said hopper said hopper having a lower wall extending from a bottom of said hopper to a location substantially above the bottom of said hopper to define a bottom of said opening,

a paddle rotatable in said hopper to stir toner such that some toner will move gently toward said opening,

an exit surface to deliver toner from said hopper on the side of said lower wall opposite said hopper, said exit surface sloping downward during normal operation of said cartridge,

an agitator member extending across said exit surface having a first pivot member on one side of said exit surface and a second pivot member on an opposite side of said exit surface and normally located proximate said exit surface except when moved by said paddle around said first pivot member and said second pivot member,

and an extension on said agitator member extending past said lower wall into the path of said paddle in said hopper when said paddle is rotated.

2. The cartridge as in claim 1 in which said extension has a depending part which contacts said lower wall to space said agitator from said exit surface when said agitator is in said proximate location.

3. The cartridge as in claim 2 in which said agitator is a bar having an extended flat surface which normally faces said exit surface until said agitator is moved by said paddle.

4. The cartridge as in claim 3 in which said opening is about four times the size of said flat surface and said flat surface covers said opening when moved by said paddle.

5. The cartridge as in claim 4 in which said exit surface is substantially flat and located at an upward angle of 50 degrees from vertical of said cartridge during normal operation of said cartridge.

6. The toner cartridge as in claim 5 in which said hopper contains electrophotographic toner for developing electrostatic images.

7. The toner cartridge as in claim 4 in which said hopper contains electrophotographic toner for developing electrostatic images.

8. The cartridge as in claim 3 in which said exit surface is substantially flat and located at an upward angle of 50 degrees from vertical of said cartridge during normal operation of said cartridge.

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9. The toner cartridge as in claim 8 in which said hopper contains electrophotographic toner for developing electrostatic images.

10. The cartridge as in claim 2 in which said exit surface is substantially flat and located at an upward angle of 50 degrees from vertical of said cartridge during normal operation of said cartridge.

11. The toner cartridge as in claim 10 in which said hopper contains electrophotographic toner for developing electrostatic images.

12. The toner cartridge as in claim 2 in which said hopper contains electrophotographic toner for developing electrostatic images.

13. The toner cartridge as in claim 3 in which said hopper contains electrophotographic toner for developing electrostatic images.

14. The cartridge as in claim 1 in which said agitator is a bar having an extended flat surface which normally faces said exit surface until said agitator is moved by said paddle.

15. The cartridge as in claim 14 in which said opening is about four times the size of said flat surface and said flat surface covers said opening when moved by said paddle.

16. The cartridge as in claim 12 in which said exit surface is substantially flat and located at an upward angle of 50 degrees from vertical of said cartridge during normal operation of said cartridge.

17. The toner cartridge as in claim 16 in which said hopper contains electrophotographic toner for developing electrostatic images.

18. The toner cartridge as in claim 15 in which said hopper contains electrophotographic toner for developing electrostatic images.

19. The cartridge as in claim 14 in which said exit surface is substantially flat and located at an upward angle of 50 degrees from vertical of said cartridge during normal operation of said cartridge.

20. The toner cartridge as in claim 19 in which said hopper contains electrophotographic toner for developing electrostatic images.

21. The toner cartridge as in claim 4 in which said hopper contains electrophotographic toner for developing electrostatic images.

22. The cartridge as in claim 1 in which said exit surface is substantially flat and located at an upward angle of 50 degrees from vertical of said cartridge during normal operation of said cartridge.

23. The toner cartridge as in claim 22 in which said hopper contains electrophotographic toner for developing electrostatic images.

24. The toner cartridge as in claim 1 in which said hopper contains electrophotographic toner for developing electrostatic images.

\* \* \* \* \*



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# THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office

December 31, 2009

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: 5,995,772

ISSUE DATE: *November 30, 1999*

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



*P. Swain*  
P. SWAIN  
Certifying Officer

US005995772A

**United States Patent** [19][11] **Patent Number:** **5,995,772****Barry et al.**[45] **Date of Patent:** **\*Nov. 30, 1999****[54] IMAGING APPARATUS CARTRIDGE  
INCLUDING AN ENCODED DEVICE**

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Lexington, Ky.

[\*] Notice: This patent is subject to a terminal dis-  
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[21] Appl. No.: **08/768,257**

[22] Filed: **Dec. 17, 1996**

**Related U.S. Application Data**

[63] Continuation-in-part of application No. 08/602,648, Feb. 16,  
1996, Pat. No. 5,634,169.

[51] **Int. Cl.<sup>6</sup>** ..... **G03G 15/08**

[52] **U.S. Cl.** ..... **399/12; 235/461; 399/27**

[58] **Field of Search** ..... **399/119, 27, 28,**  
**399/262, 258, 12; 235/461; 222/DIG. 1**

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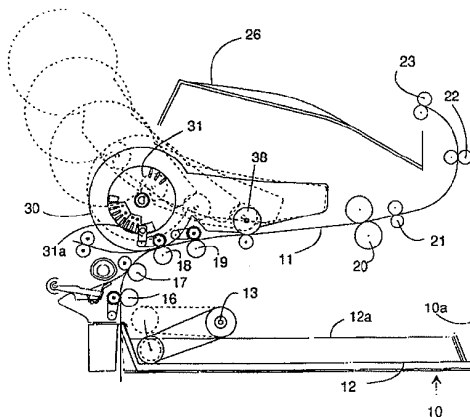
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*Primary Examiner*—William Royer  
*Assistant Examiner*—Quana Grainger  
*Attorney, Agent, or Firm*—John J McArdle, Jr.

**[57] ABSTRACT**

A cartridge for an electrophotographic machine having a sump for carrying an agitator rotatably mounted in the sump for engagement with a toner; an encoded device coupled to a first end of the agitator; and a torque sensitive coupling connected to a second end of the agitator which is connectable to a drive mechanism of the machine. The encoded device includes coding representing cartridge characteristic information.

**39 Claims, 17 Drawing Sheets**

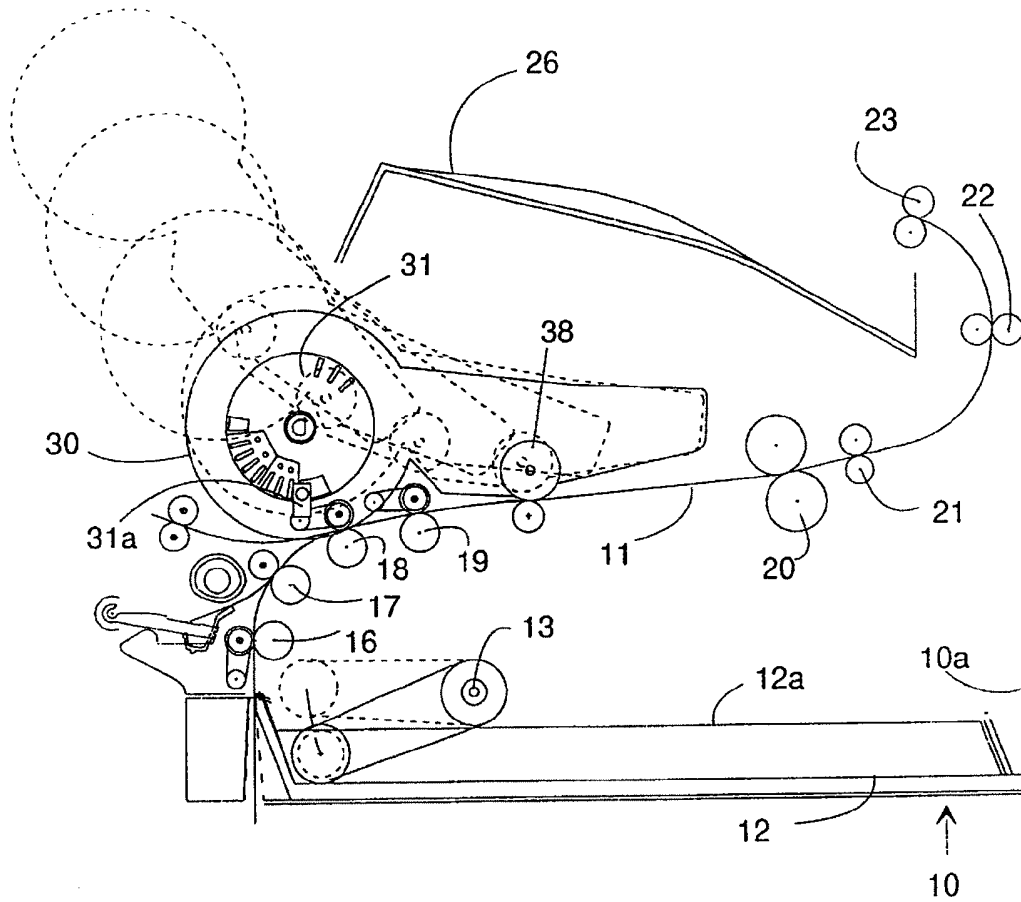


Fig. 1

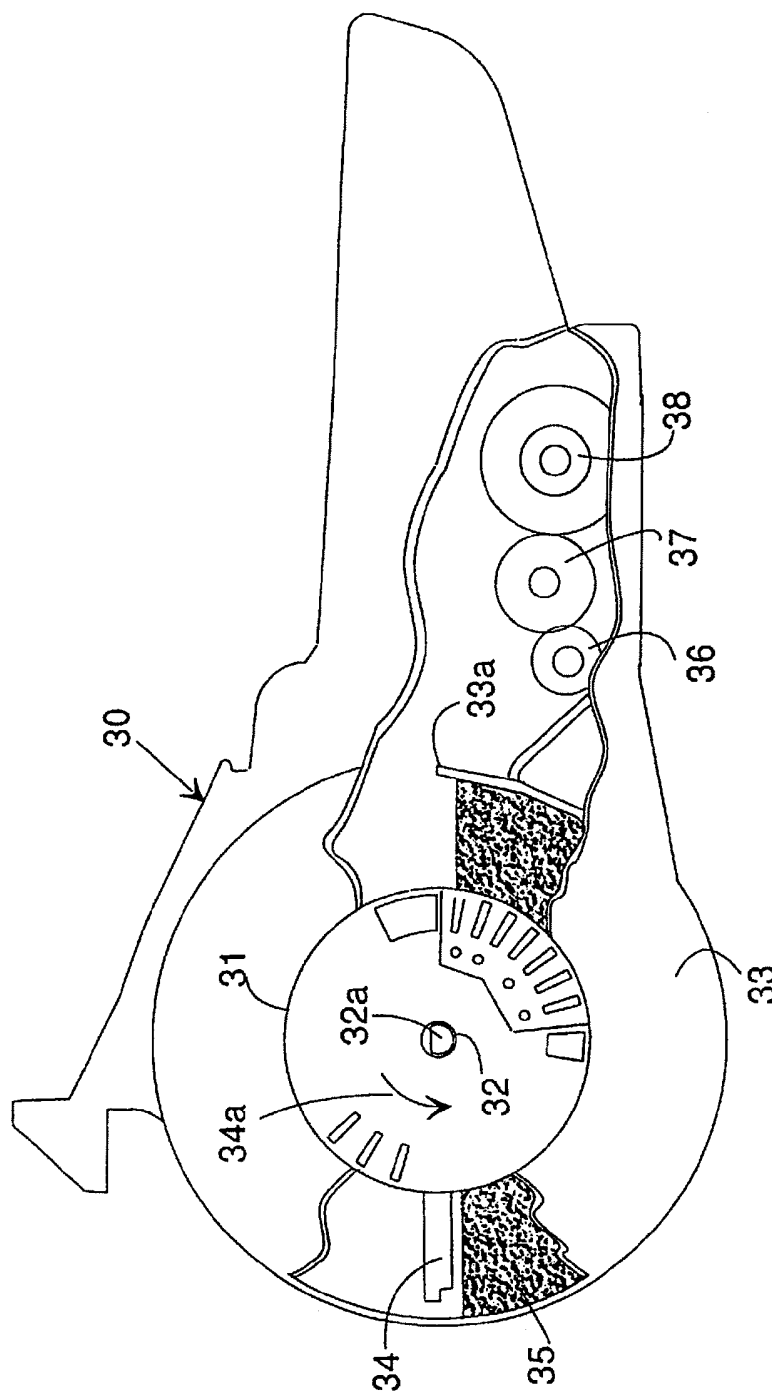


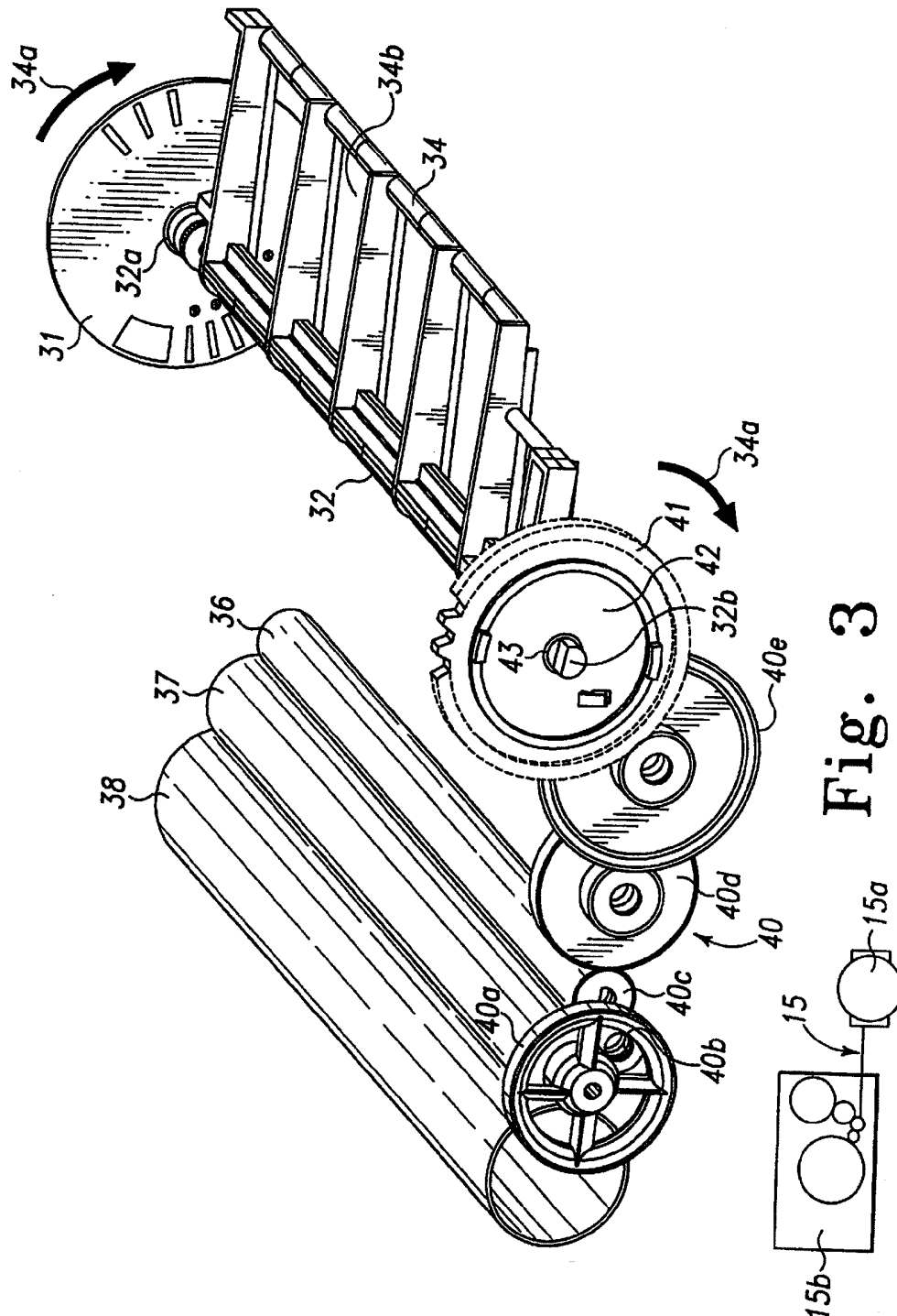
Fig. 2

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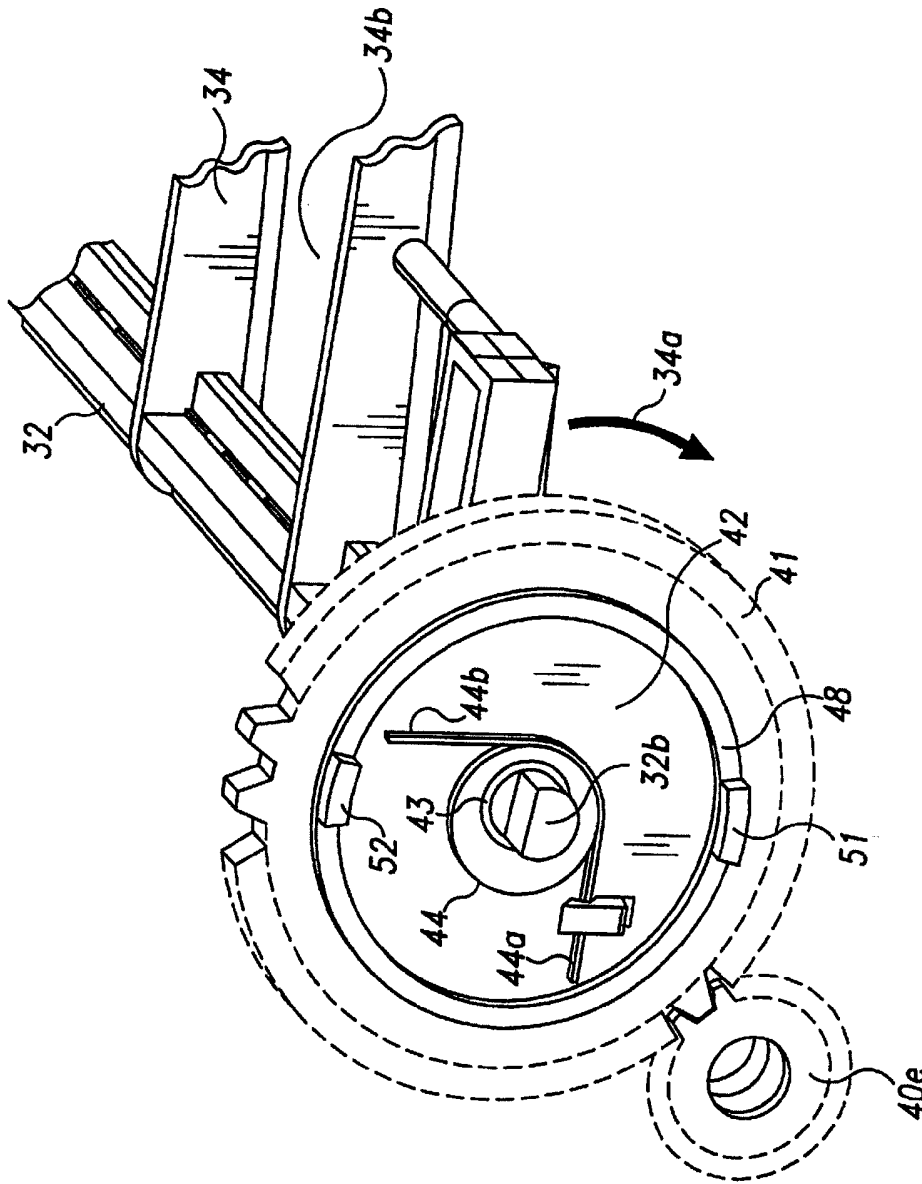


Fig. 4



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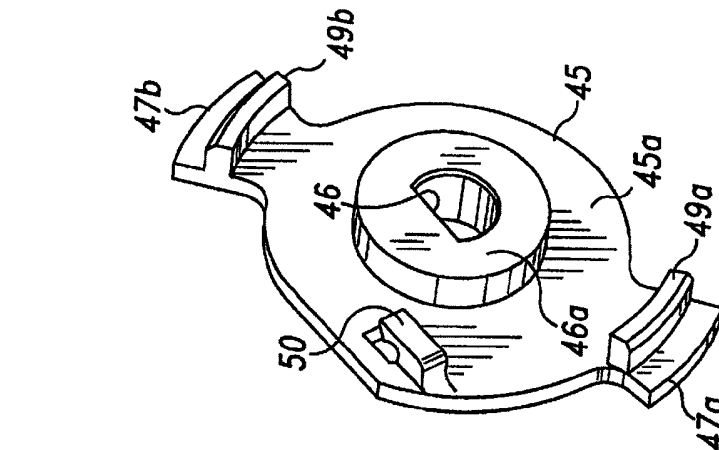


Fig. 5B

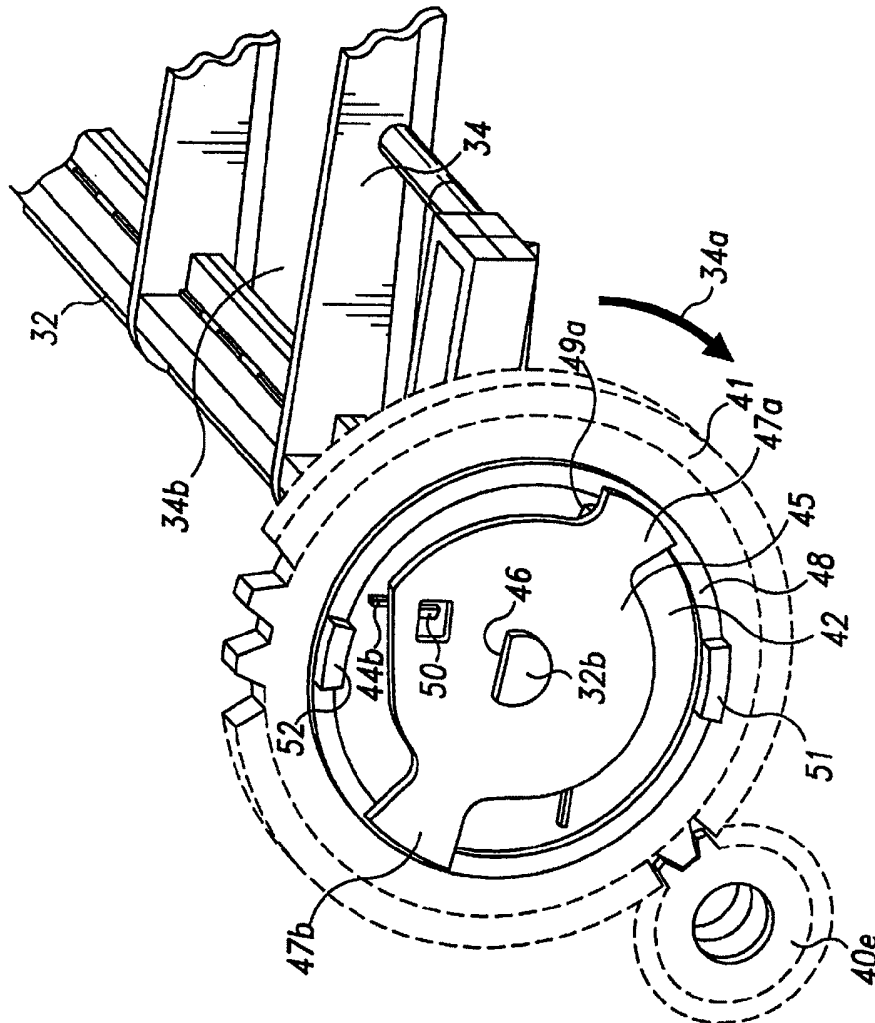


Fig. 5A

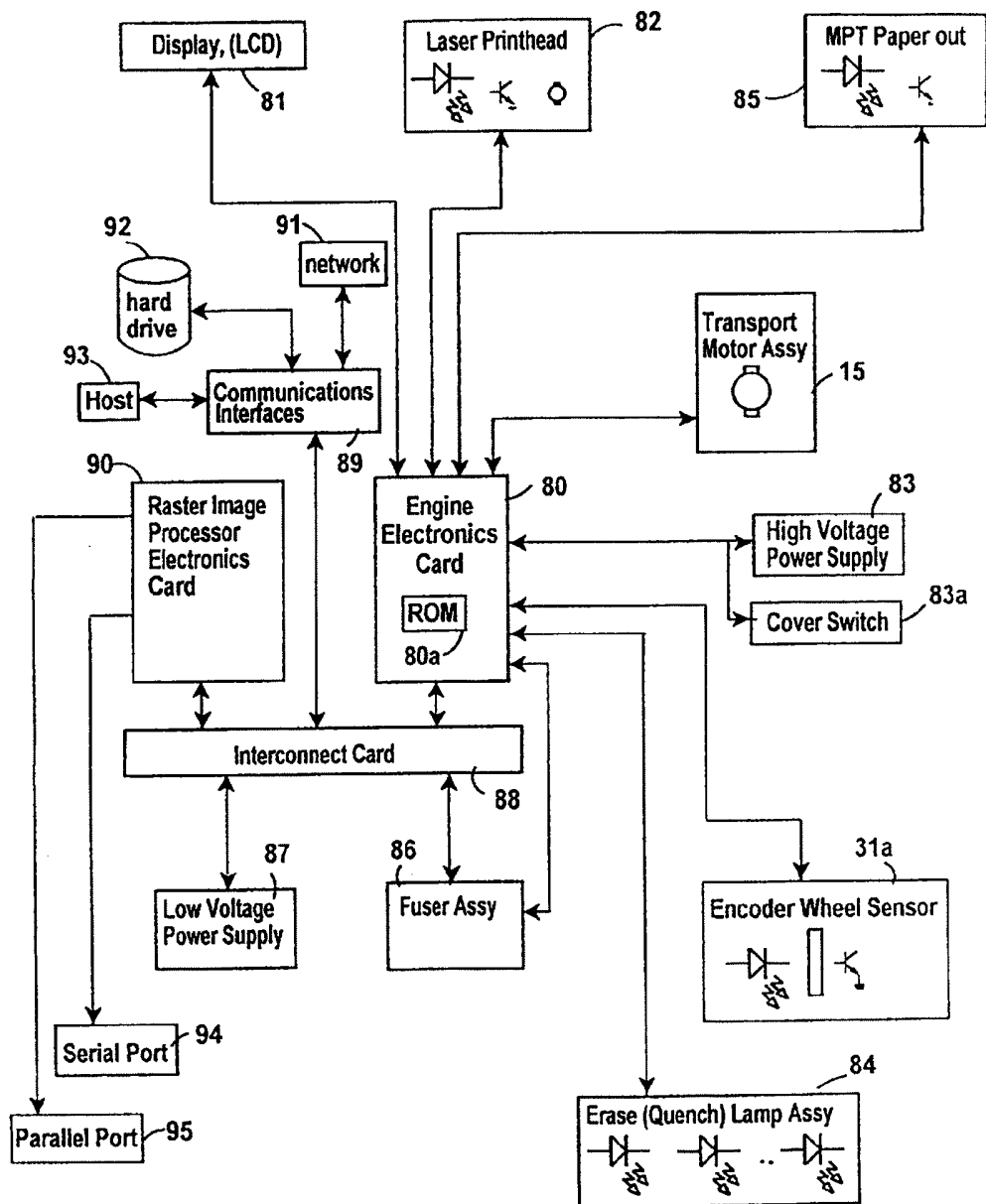


Fig. 6

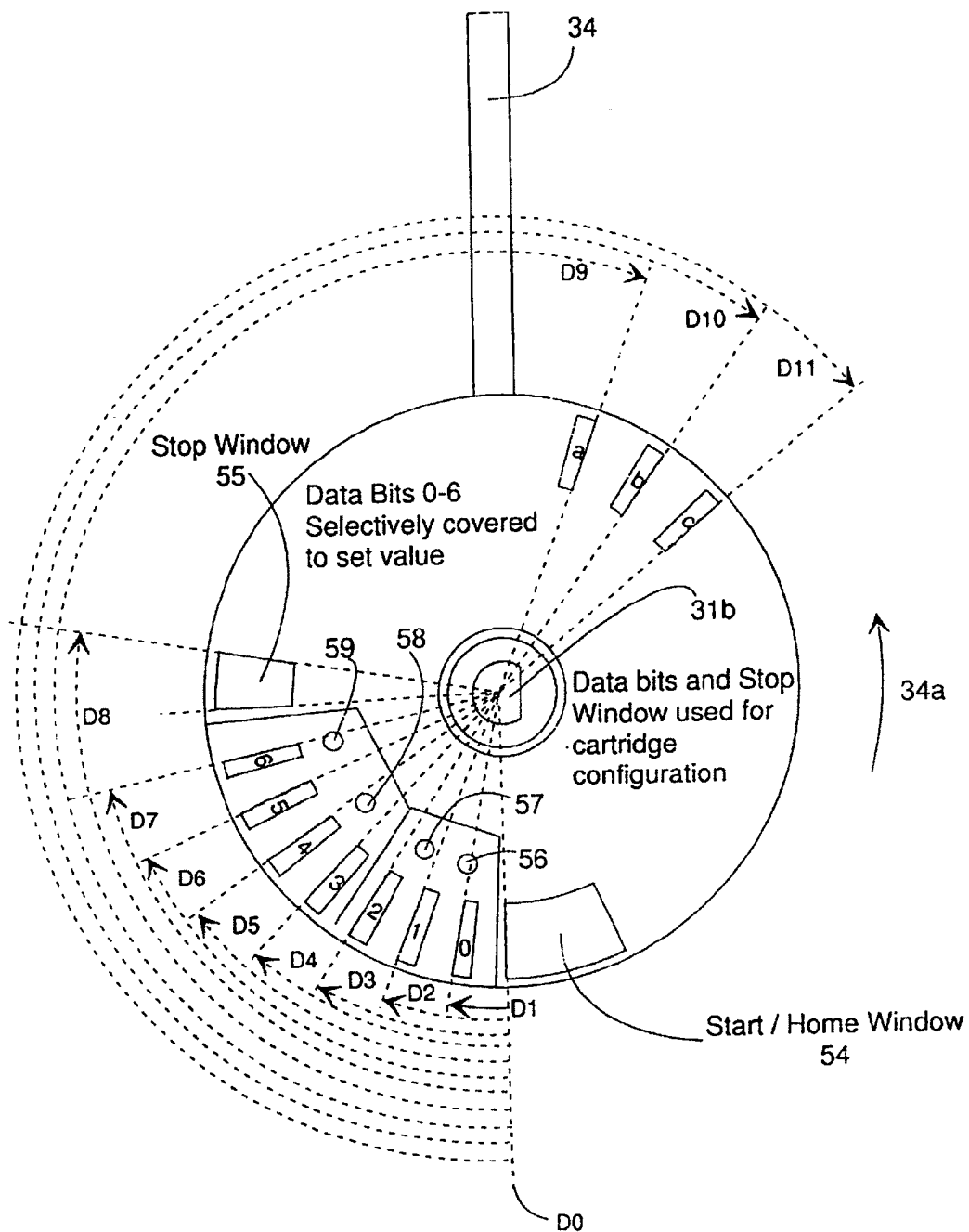


Fig. 7

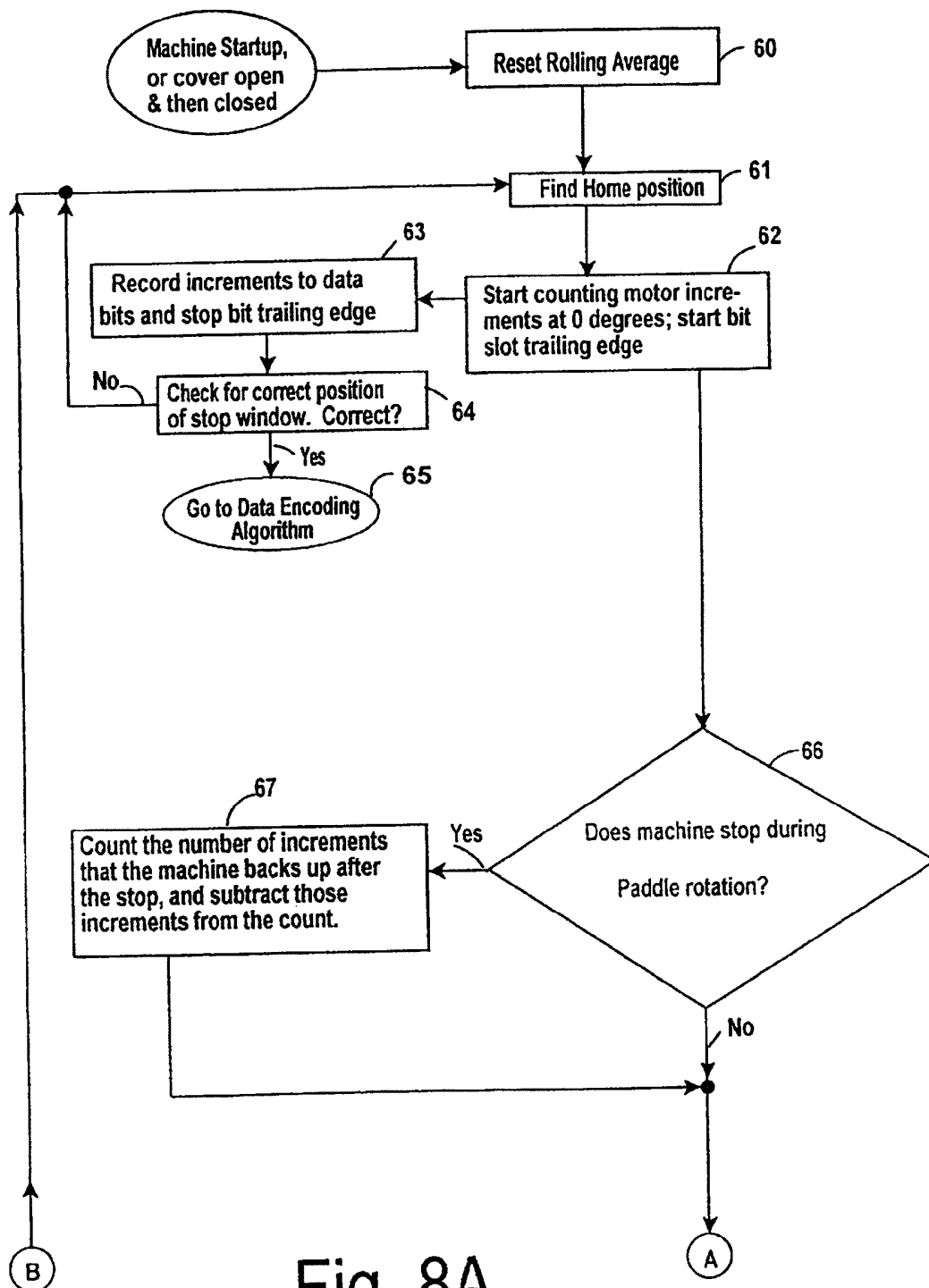


Fig. 8A

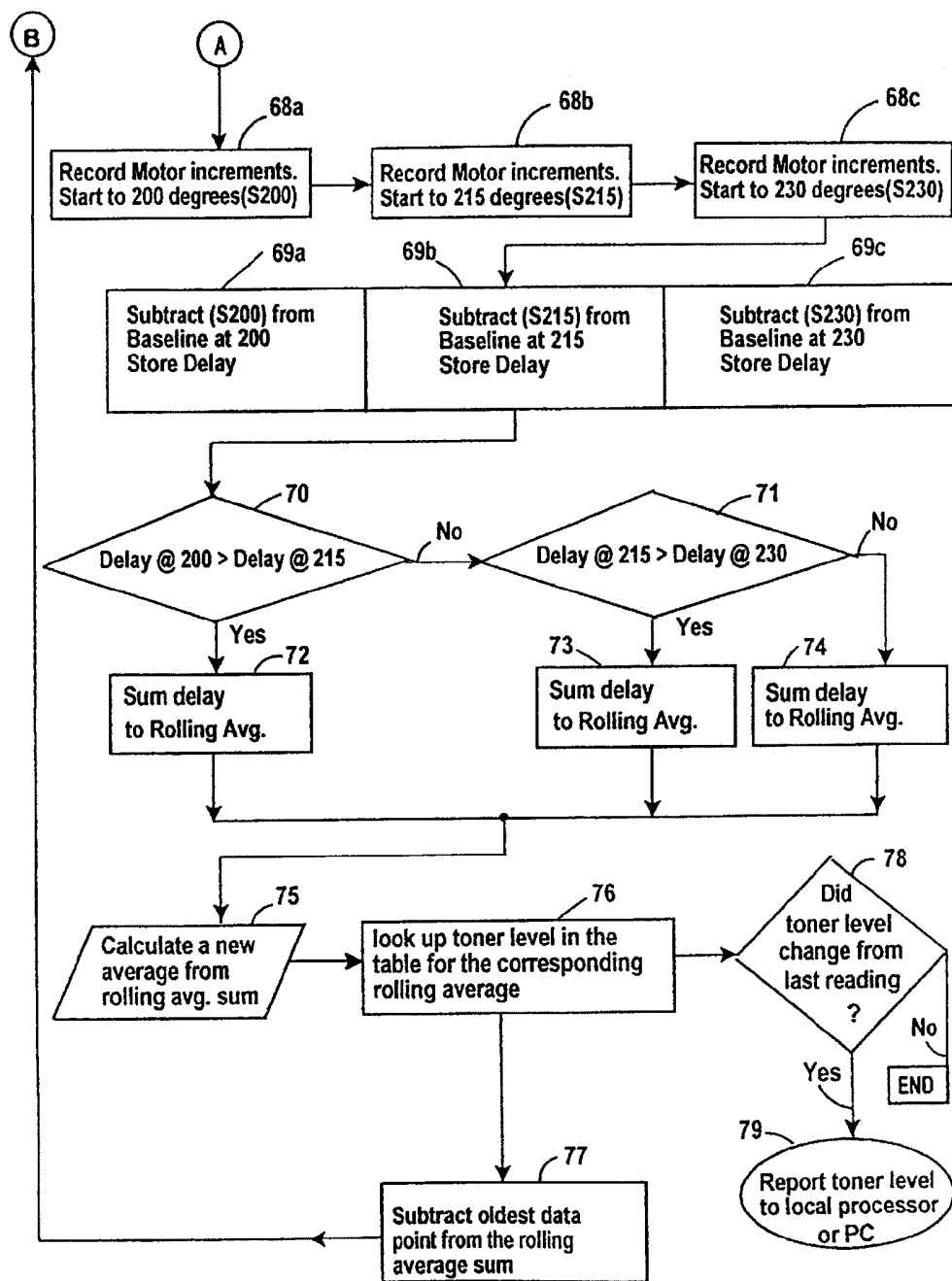


Fig. 8B

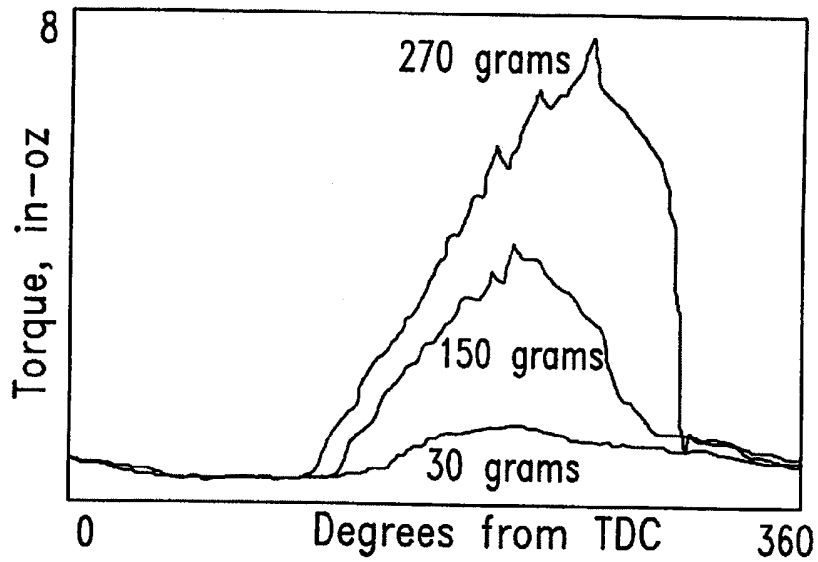


Fig. 9

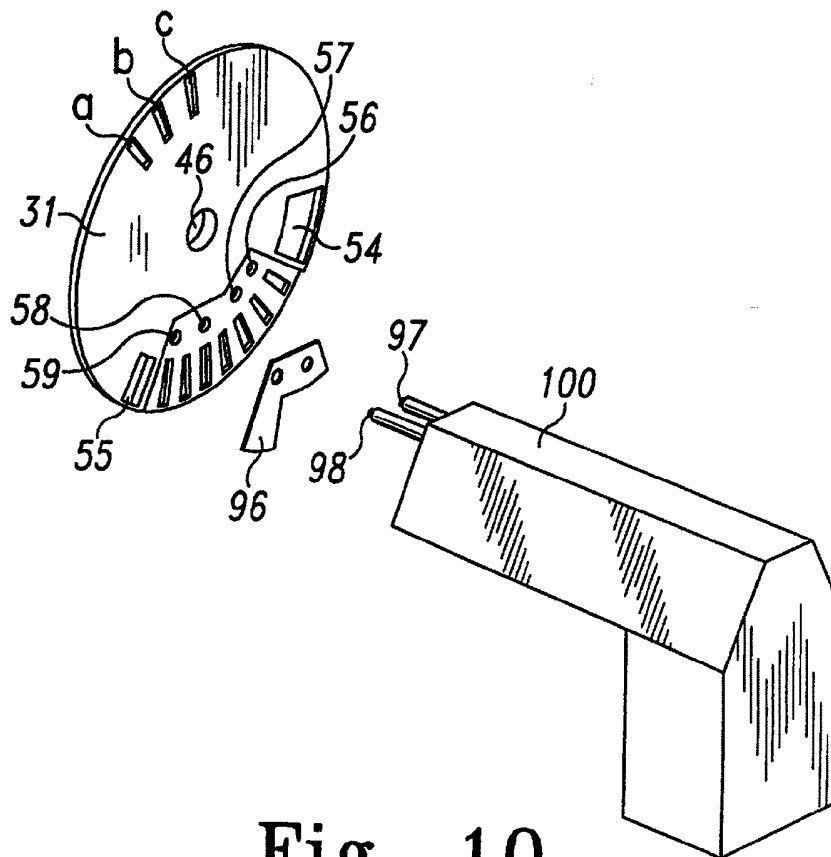


Fig. 10



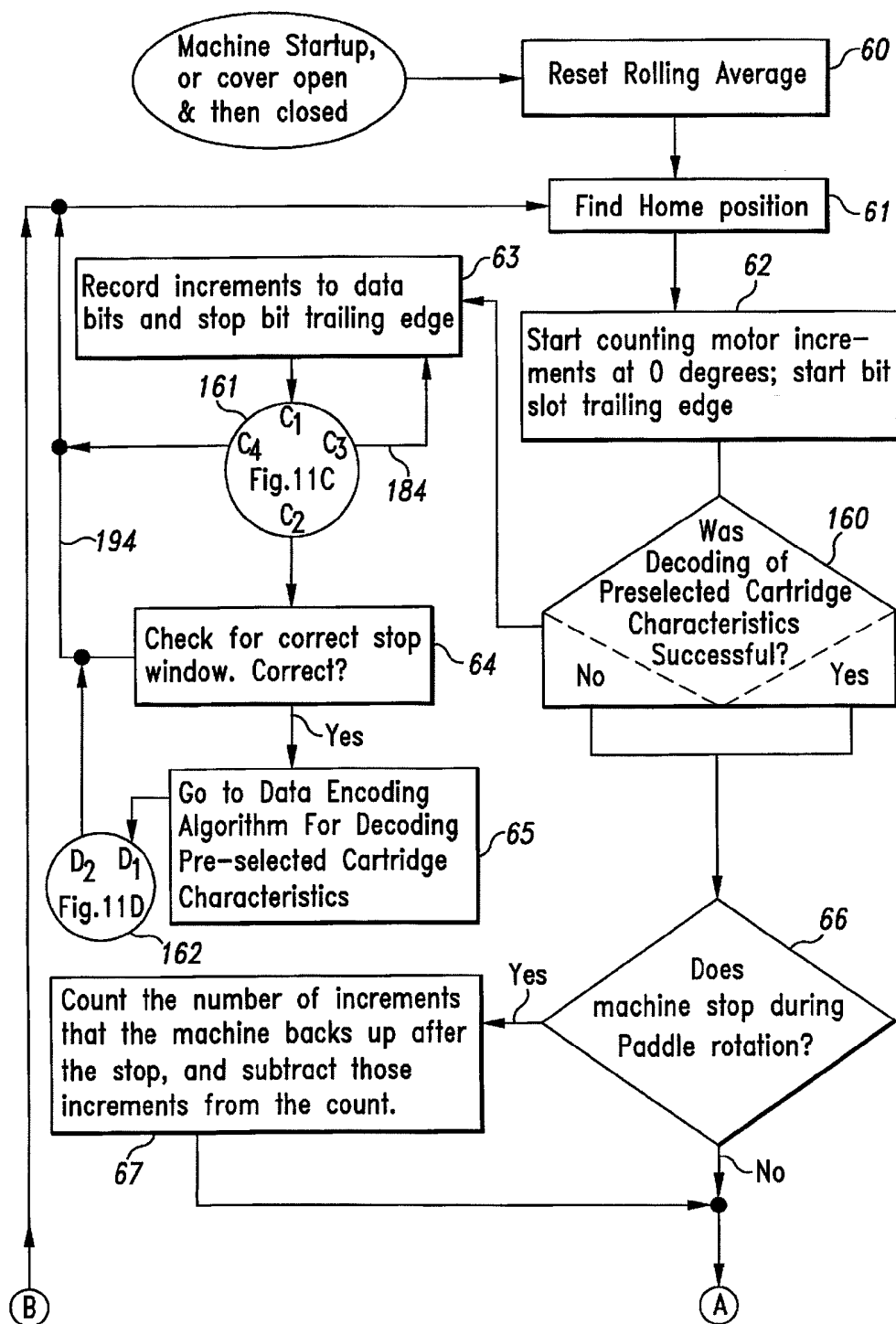


Fig. 11A

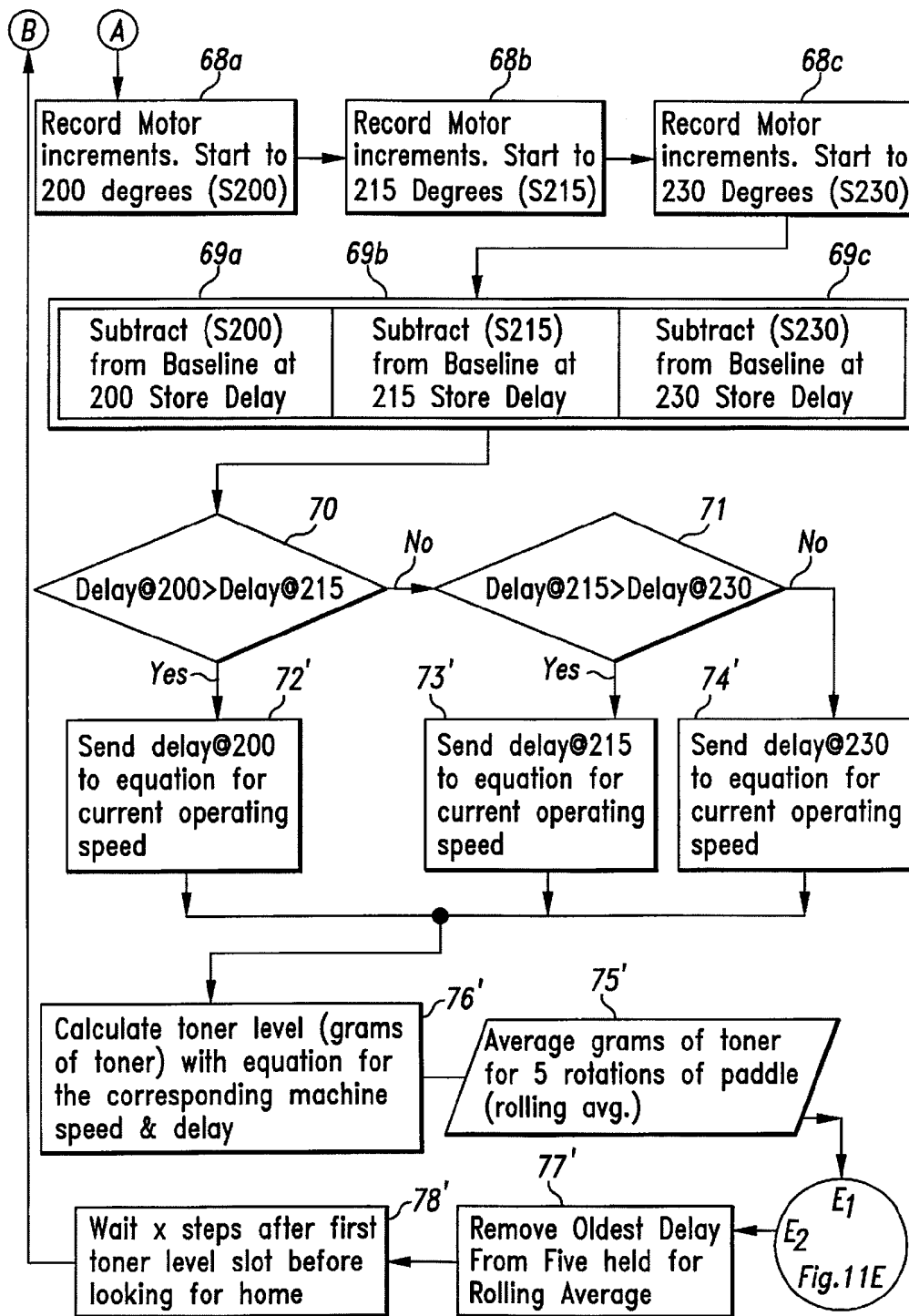


Fig. 11B

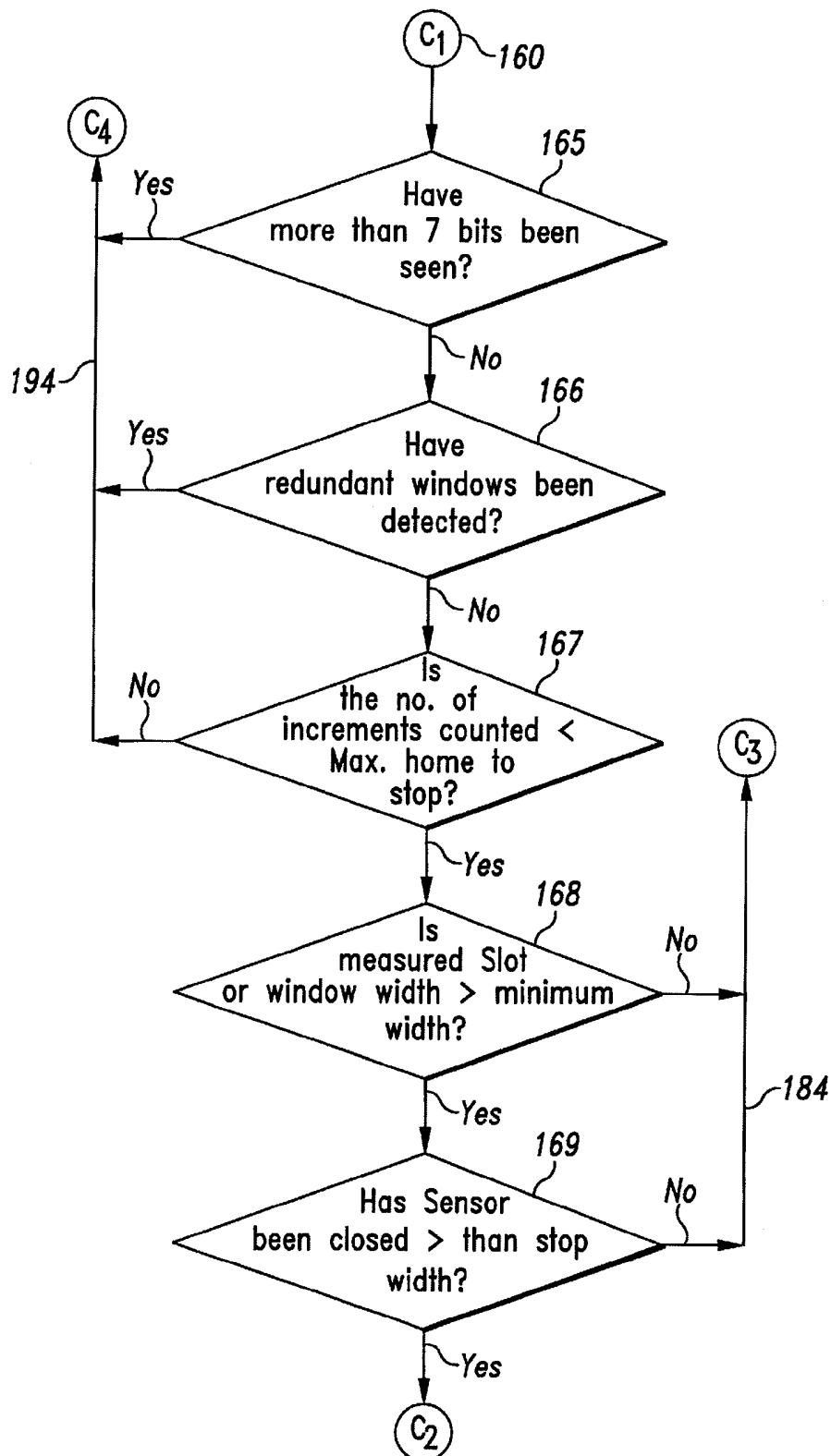


Fig. 11C

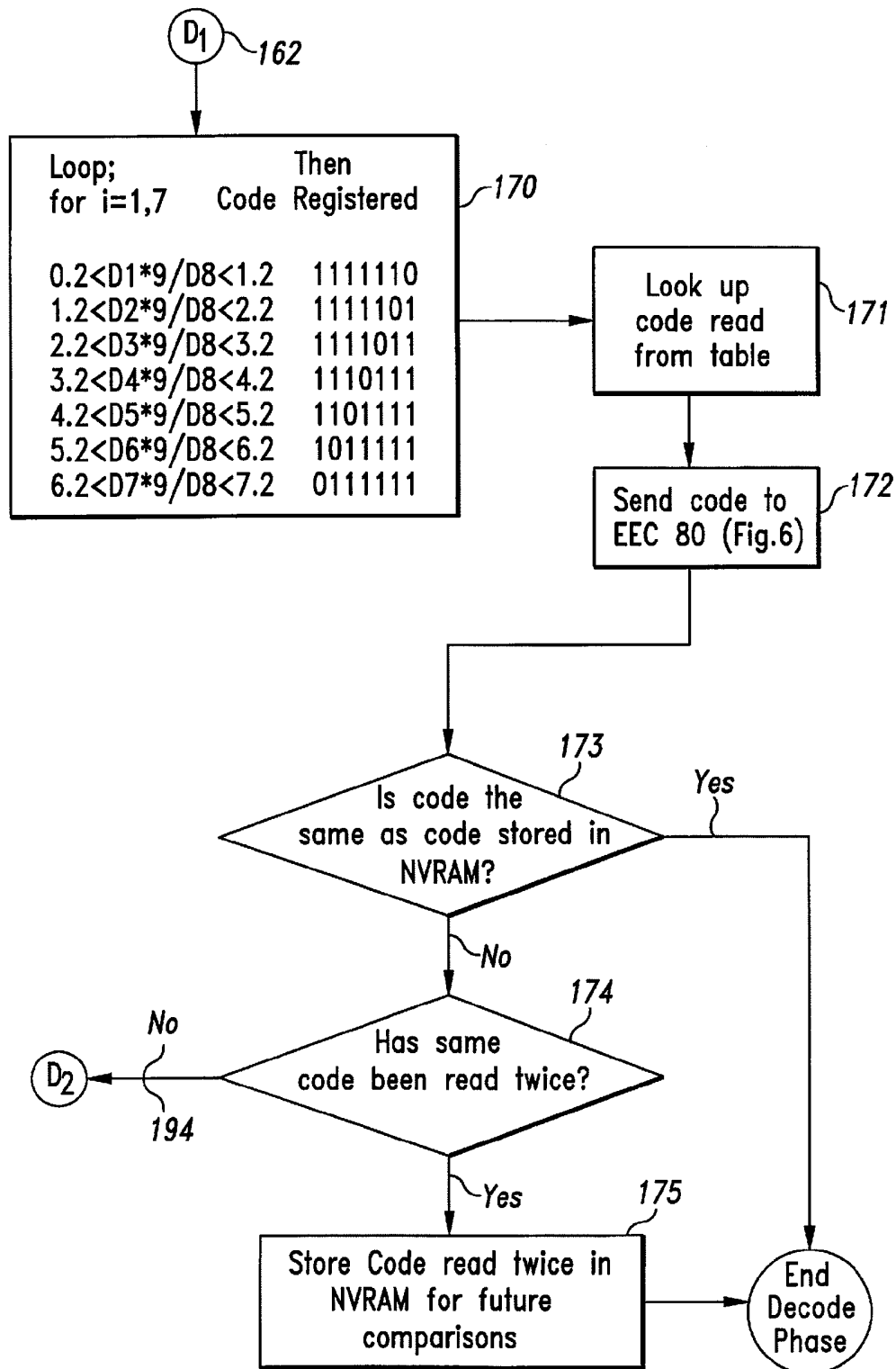


Fig. 11D

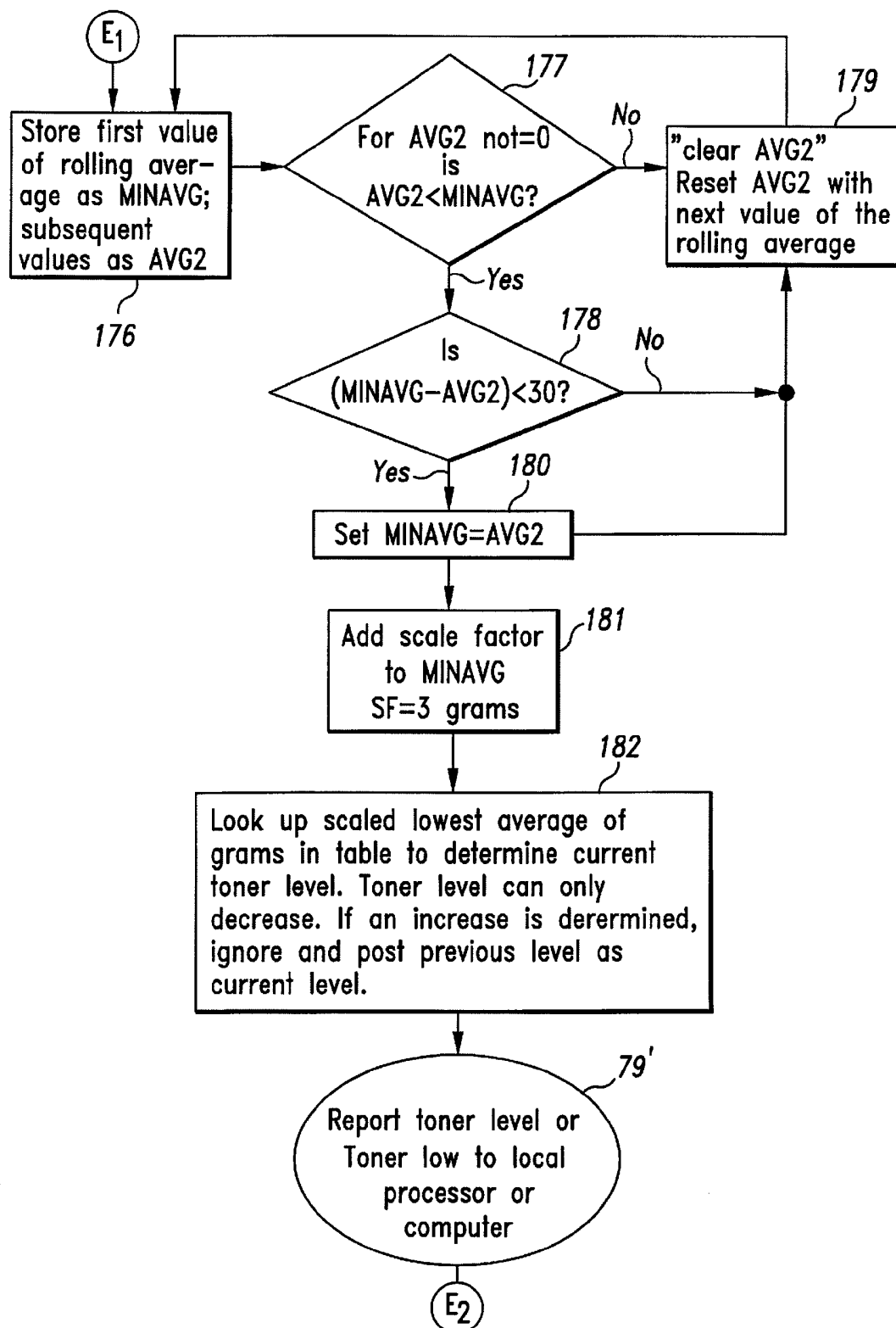


Fig. 11E

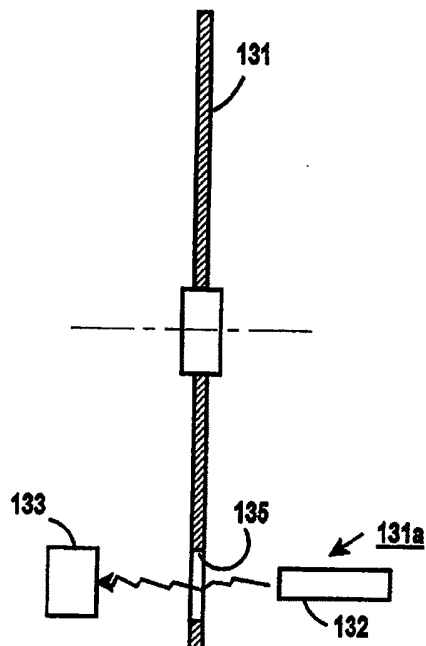


Fig. 12

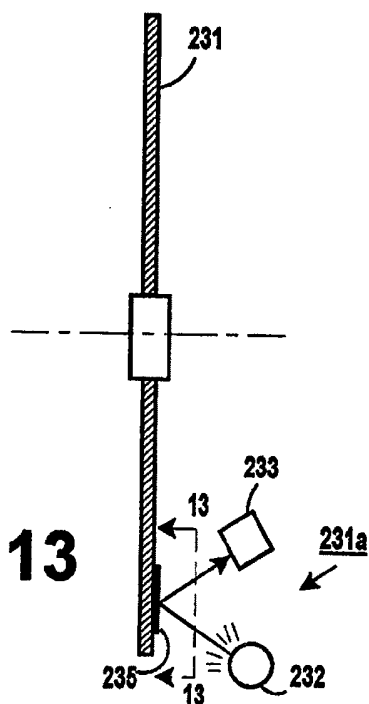


Fig. 13

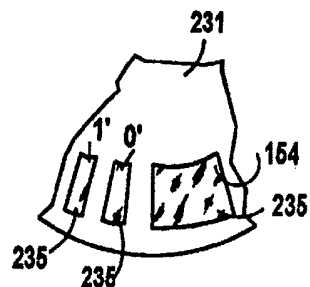


Fig. 14



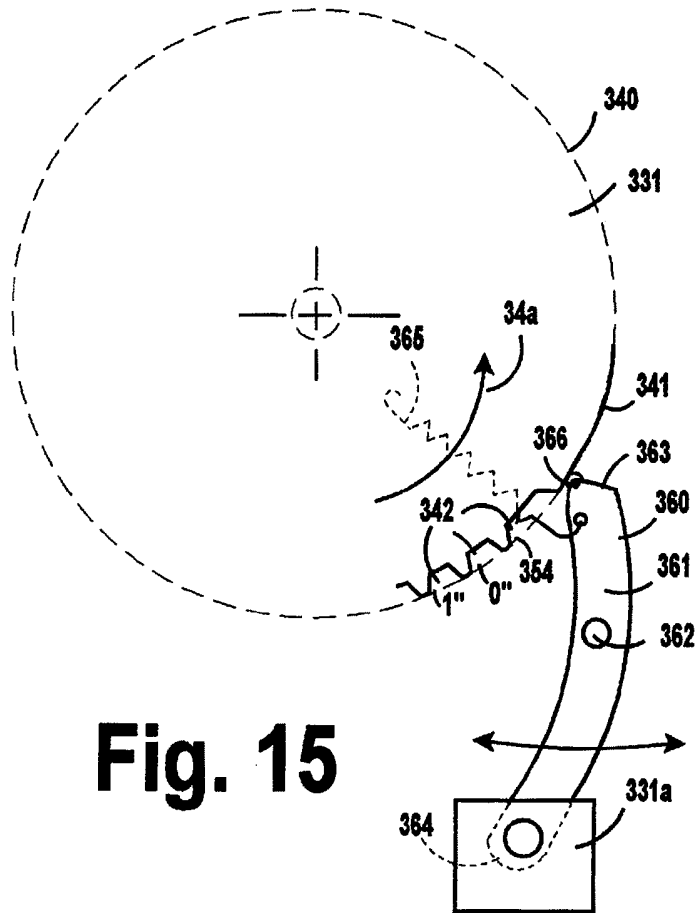


Fig. 15

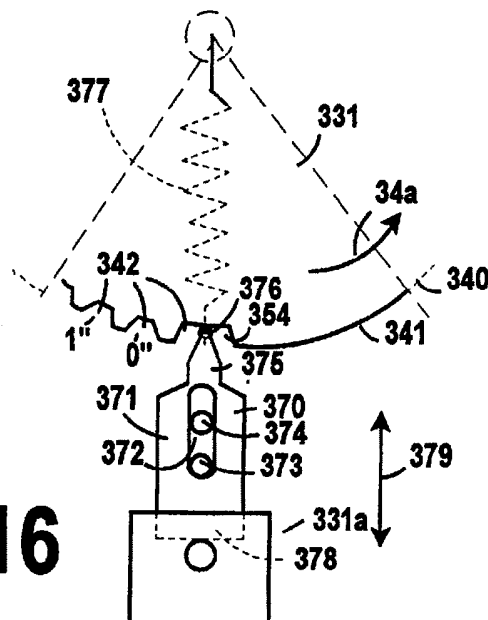


Fig. 16

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## IMAGING APPARATUS CARTRIDGE INCLUDING AN ENCODED DEVICE

This application is a continuation-in-part of application Ser. No. 08/602,648 filed on Feb. 16, 1996, now U.S. Pat. No. 5,634,169.

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### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to Electrophotographic (EP) machines and more particularly relates to methods and apparatus associated with replaceable supply cartridges for such machines wherein information concerning the cartridge is provided to the machine to promote correct and efficient operation thereof.

#### 2. Description of Related Art

Many Electrophotographic output device (e.g., laser printers, copiers, fax machines etc.) manufacturers such as Lexmark International, Inc., have traditionally required information about the EP cartridge to be available to the output device such that the control of the machine can be altered to yield the best print quality and longest cartridge life.

The art is replete with devices or entry methods to inform the EP machine about specific EP cartridge characteristics. For example, U.S. Pat. No. 5,208,631 issued on May 4, 1993, discloses a technique to identify calorimetric properties of toner contained within a cartridge in a reproduction machine by imbedding in a PROM within the cartridge specific coordinates of a color coordinate system for mapping color data.

In other prior art, for example U.S. Pat. No. 5,289,242 issued on Feb. 22, 1994, there is disclosed a method and system for indicating the type of toner print cartridge which has been loaded into an EP printer. Essentially, this comprises a conductive strip mounted on the cartridge for mating with contacts in the machine when the lid or cover is closed. The sensor is a two position switch which tells the user the type of print cartridge which has been loaded into the printer. While this method is effective, the amount of information that can be provided to the machine is limited.

In still other prior art, such as in U.S. Pat. No. 5,365,312 issued on Nov. 15, 1994, a memory chip containing information about the current fill status or other status data is retained. The depleted status of print medium is supplied by counting consumption empirically. The average of how much toner is required for toning a charge image is multiplied by the number of revolutions of the charge image carrier or by the degree of inking of the characters via an optical sensor. In either method, the count is less than accurate and depends upon average ink coverage on the page, or alternatively, the character density which can change dramatically due to font selection. Therefore at best, the consumption count lacks accuracy.

The literature suggests several methods for detecting toner level in a laser printer. Most of these methods detect a low toner condition or whether toner is above or below a fixed level. Few methods or apparatus effectively measure

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the amount of unused toner remaining. As an example, Lexmark® printers currently employ an optical technique to detect a low toner condition. This method attempts to pass a beam of light through a section of the toner reservoir onto a photo sensor. Toner blocks the beam until its level drops below a preset height.

Another common method measures the effect of toner on a rotating agitator or toner paddle which stirs and moves the toner over a sill to present it to a toner adder roll, then developer roll and ultimately the PC Drum. The paddle's axis of rotation is horizontal. As it proceeds through its fall 360 degree rotation the paddle enters and exits the toner supply. Between the point where the paddle contacts the toner surface and the point where it exits the toner, the toner resists the motion of the paddle and produces a torque load on the paddle shaft. Low toner is detected by either 1) detecting if the torque load caused by the presence of toner is below a given threshold at a fixed paddle location or 2) detecting if the surface of the toner is below a fixed height.

In either method there is a driving member supplying drive torque to a driven member (the paddle) which experiences a load torque when contacting the toner. Some degree of freedom exists for these two members to rotate independently of each other in a carefully defined manner. For the first method 1) above, with no load applied to the paddle, both members rotate together. However, when loaded the paddle lags the driving member by an angular distance that increases with increasing load. In the second method 2), the unloaded paddle leads the rotation of the driving member, under the force of a spring or gravity. When loaded (i.e., the paddle contacts the surface of the toner), the driving and driven members come back into alignment and rotate together. By measuring the relative rotational displacement of the driving and driven members (a.k.a. phase difference) at an appropriate place in the paddle's rotation, the presence of toner can be sensed.

In the prior art, this relative displacement is sensed by measuring the phase difference of two disks. The first disk is rigidly attached to a shaft that provides the driving torque for the paddle. The second disk is rigidly attached to the shaft of the paddle and in proximity to the first disk. Usually both disks have matching notches or slots in them. The alignment of the slots or notches, that is how much they overlap, indicates the phase relationship of the disks and therefore the phase of the driving and driven members.

Various art showing the above methods and variations are set forth below.

In U.S. Pat. No. 4,003,258, issued on Jan. 18, 1977 to Ricoh Co., is disclosed the use of two disks to measure toner paddle location relative to the paddle drive shaft. When the paddle reaches the top of its rotation the coupling between paddle and drive shaft allows the paddle to free fall under the force of gravity until it comes to rest on the toner surface or at the bottom of its rotation. Toner low is detected if the angle through which the paddle falls is greater than a fixed amount (close to 180 degrees). A spring connects the two disks, but the spring is not used for toner detection. It is used to fling toner from the toner reservoir to the developer.

In U.S. Pat. No. 5,216,462, issued to Oki Electric Co., Jun. 1, 1993, is described a system where a spring connects two disks so that the phase separation of the disks indicates torque load on the paddle. An instability is noted in this type of system. It farther describes a system similar to the Patent above where the paddle free falls from its top dead position to the surface of the toner. The position of the paddle is sensed through magnetic coupling to a lever outside of the

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toner reservoir. This lever activates an optical switch when the paddle is near the bottom of its rotation. A low toner indication results when the time taken for the paddle to fall from top dead center to the bottom of the reservoir, as sensed by the optical switch, is less than a given value.

In U.S. Pat. No. 4,592,642, issued on Jun. 3, 1986 to Minolta Camera Co., is described a system that does not use the paddle directly to measure toner, but instead uses the motion of the paddle to lift a "float" above the surface of the toner and drop it back down on top of the toner surface. A switch is activated by the "float" when in the low toner position. If the "float" spends a substantial amount of time in the low toner position the device signals low toner. Although the patent implies that the amount of toner in the reservoir can be measured, the description indicates that it behaves in a very non-linear, almost binary way to merely detect a toner low state.

U.S. Pat. No. 4,989,754, issued on Feb. 5, 1991 to Xerox Corp., differs from the others in that there is no internal paddle to agitate or deliver toner. Instead the whole toner reservoir rotates about a horizontal axis. As the toner inside rotates with the reservoir it drags a rotatable lever along with it. When the toner level becomes low, the lever, no longer displaced from its home position by the movement of the toner, returns to its home position under the force of gravity. From this position the lever activates a switch to indicate low toner.

In still another U.S. Pat. No. 4,711,561, issued on Dec. 8, 1987 to Rank Xerox Limited, this patent describes a means of detecting when a waste toner tank is full. It employs a float that gets pushed upward by waste toner fed into the tank from the bottom. The float activates a switch when it reaches the top of the tank.

U.S. Pat. No. 5,036,363, issued on Jul. 30, 1991 to Fujitsu Limited, describes the use of a commercially available vibration sensor to detect the presence of toner at a fixed level. The patent describes a simple timing method for ignoring the effect of the sensor cleaning mechanism on the sensor output.

U.S. Pat. No. 5,349,377, issued on Sept. 20, 1994 to Xerox Corp. discloses an algorithm for calculating toner usage and hence amount of toner remaining in the reservoir by counting black pixels and weighting them for toner usage based on pixels per unit area in the pixel's neighborhood. This is unlike the inventive method and apparatus disclosed hereinafter.

### SUMMARY OF THE INVENTION

The present invention is related to apparatus and method for representing cartridge characteristic information by an encoded device, and for reading such information from the encoded device.

One aspect of the invention is directed to a cartridge for an electrophotographic machine, including a sump for carrying an agitator rotatably mounted in the sump for engagement with a toner; an encoded device coupled to a first end of the agitator; and a torque sensitive coupling connected to a second end of the agitator, which is connectable to a drive mechanism in the machine. The encoded device includes coding means representing cartridge characteristic information. Such coding means may include coding readable to indicate a component of a resistance to agitator movement through a portion of said sump having toner therein to give an indication of an amount of toner remaining in said sump. The component of resistance representative of the amount of toner remaining in the sump is determined by the lag

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between a travel of the drive mechanism in relation to a travel of the encoded device. Also, such coding means may include, alternatively or in addition to the coding readable for indicating an amount of toner, a coding representing preselected cartridge characteristic information.

Another aspect of the invention is directed to a cartridge having a single encoded plate rotating in relation to an agitator, wherein the single encoded plate includes coding for determining a quantity of toner in the cartridge, and another aspect of the invention is directed to a cartridge having an encoded plate, wherein the encoded plate includes coding representing preselected cartridge information. Such coding preferably includes a plurality of coding indicators, such as for example, openings, windows, notches, or reflective areas, formed in and/or on the encoded plate. Still another aspect of the invention is directed to a reader for reading the coding indicators of the encoded plate.

One method of determining the quantity of toner in the cartridge of the invention includes the steps of determining a rotational position of the drive mechanism; determining a relative position of the encoded plate; and measuring the lag between the rotational position of said drive mechanism and the relative rotational position of said encoded plate.

Other features and advantages of the invention may be determined from the drawings and detailed description of the invention that follows.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevational view illustrating the paper path in a typical electrophotographic machine, in the illustrated instance a printer, and showing a replacement supply EP cartridge, constructed in accordance with the present invention, and the manner of insertion thereof into the machine;

FIG. 2 is a fragmentary, enlarged, simplified, side elevational view of the cartridge illustrated in FIG. 1, and removed from the machine of FIG. 1;

FIG. 3 is a fragmentary perspective view of the interior driven parts of the EP cartridge illustrated in FIGS. 1 and 2, including the encoder wheel and its relative position with regard to the drive mechanism for the cartridge interior driven parts;

FIG. 4 is an enlarged fragmentary perspective view of the agitator/paddle drive for the toner sump, and illustrating a portion of the torque sensitive coupling between the drive gear and the driven shaft for the agitator/paddle;

FIG. 5A is a fragmentary view similar to FIG. 4, except illustrating another portion of the torque sensitive coupling for coupling the driven shaft for the agitator/paddle, through the coupling to the drive gear, and FIG. 5B depicts the reverse side of one-half of the torque sensitive coupling, and that portion which connects to the agitator/paddle shaft;

FIG. 6 is a simplified electrical diagram for the machine of FIG. 1, and illustrating the principal parts of the electrical circuit;

FIG. 7 is an enlarged side elevational view of the encoder wheel employed in accordance with the present invention, and viewed from the same side as shown in FIG. 2, and from the opposite side as shown in FIG. 3;

FIG. 8A is a first portion of a flow chart illustrating the code necessary for machine start up, and the reading of information coded on the encoder wheel;

FIG. 8B is a second portion of the flow chart of FIG. 8A illustrating the measurement of toner level in the toner sump;

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FIG. 9 is a graphical display of the torque curves for three different toner levels within the sump, and at various positions of the toner paddle relative to top dead center or the home position of the encoder wheel;

FIG. 10 is a perspective view of an encoder wheel with novel apparatus for blocking off selected slots in the encoder wheel for coding the wheel with EP cartridge information.

FIGS. 11A–11E represent in flow chart form an alternative method for machine start up, the reading of information coded on the encoder wheel and the measurement of toner level in the toner sump;

FIG. 12 is a sectional view of an encoder wheel and a schematic representation of an alternative Hall effect reader/sensor of the invention;

FIG. 13 is a sectional view of an encoder wheel and a schematic representation of an alternative reflective reader/sensor of the invention;

FIG. 14 is a fragmentary side elevational view of a portion of the encoder wheel of FIG. 12 and taken along line 13–13 of FIG. 12;

FIG. 15 is a fragmentary side elevational view of an encoder wheel with a cam surface implementation and a cam follower reader/sensor mechanism; and

FIG. 16 is a fragmentary side elevational view of an encoder wheel with a cam surface implementation and an alternative cam follower reader/sensor mechanism.

#### DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENTS

Turning now to the drawings, and particularly FIG. 1 thereof, a laser printer constructed in accordance with the present invention, is illustrated therein. FIG. 1 shows a schematic side elevational view of the printer 10, illustrating the print receiving media path 11 and including a replacement supply electrophotographic (EP) cartridge 30, constructed in accordance with the present invention. As illustrated, the machine 10 includes a casing or housing 10a which supports at least one media supply tray 12, which by way of a picker arm 13, feeds cut sheets of print receiving media 12a (e.g., paper) into the media path 11, past the print engine which forms in the present instance part of the cartridge 30, and through the machine 10. A transport motor drive assembly 15 (FIG. 3) affords the driving action for feeding the media through and between the nips of pinch roller pairs 16–23 into a media receiving output tray 26.

In accordance with the invention, and referring now to FIGS. 1 & 2, the cartridge 30 includes an encoder wheel 31 adapted for coaction, when the cartridge 30 is nested in its home position within the machine 10, with an encoder wheel sensor or reader 31a for conveying or transmitting to the machine 10 information concerning cartridge characteristics including continuing data (while the machine is running) concerning the amount of toner remaining within the cartridge and/or preselected cartridge characteristics, such as for example, cartridge type or size, toner capacity, toner type, photoconductive drum type, etc. To this end, the encoder wheel 31 is mounted, in the illustrated instance on one end 32a of a shaft 32, which shaft is coaxially mounted for rotation within a cylindrical toner supply sump 33. Mounted on the shaft 32 for synchronous rotation with the encoder wheel 31, extending radially from the shaft 32 and axially along the sump 33 is a toner agitator or paddle 34. The toner 35 level for a cartridge (depending upon capacity) is generally as shown extending from approximately the 9:00 position and then counter clockwise to the 3:00 posi-

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tion. As the paddle 34 rotates counter clockwise in the direction of the arrow 34a, toner tends to be moved over the sill 33a of the sump 33. (The paddle 34 is conventionally provided with large openings 34b, FIG. 3, to provide lower resistance thereto as it passes through the toner 35.) As best shown in FIGS. 2 & 3, the toner that is moved over the sill 33a, is presented to a toner adder roll 36, which interacts in a known manner with a developer roll 37 and then a photo conductive (PC) drum 38 which is in the media path 11 for applying text and graphical information to the print receiving media 12a presented thereto in the media path 11.

Referring now to FIG. 3, the motor transport assembly 15 includes a drive motor 15a, which is coupled through suitable gearing and drive take-offs 15b to provide multiple and differing drive rotations to, for example, the PC drum 38 and a drive train 40 for the developer roll 37, the toner adder roll 36 and through a variable torque arrangement, to one end 32b of the shaft 32. The drive motor 15a may be of any convenient type, e.g., a stepping motor or in the preferred embodiment a brushless DC motor. While any of several types of motors may be employed for the drive, including stepping motors, a brushless DC motor is ideal because of the availability of either hall effect or frequency generated feedback pulses which present measurable and finite increments of movement of the motor shaft. The feedback accounts for a predetermined distance measurement, which will be referred to as an increment rather than a 'step' so as not to limit the drive to a stepping motor.

The drive train 40, which in the present instance forms part of the cartridge 30, includes driven gear 40a, which is directly coupled to the developer roll 37, and through an idler gear 40b is coupled to the toner adder roll 36 by gear 40c. Gear 40c in turn through suitable reduction gears 40d and 40e drives final drive gear 41. In a manner more fully explained below with reference to FIGS. 5 & 6, the drive gear 41 is coupled to the end 32b of shaft 32 through a variable torque sensitive coupling.

In FIG. 3, the gear 41 is shown as including an attached web or flange 42 connected to a collar 43 which acts as a bearing permitting, absent restraint, free movement of the gear 41 and its web 42 about the end 32b of the shaft 32. Referring now to FIG. 4, the driving half of the variable torque sensitive coupling is mounted on the web 42 of the gear 41. To this end, the driving half of the coupling includes a coiled torsion spring 44, one leg 44a of which is secured to the web 42 of the gear 41, the other leg 44b of which is free standing.

Turning now to FIG. 5A, the other half (driven half) of the coupling is illustrated therein. To this end, an arbor 45 having a keyed central opening 46 dimensioned for receiving the keyed (flat) shaft end 32b of the shaft 32, is depicted therein. For ease of understanding, an inset drawing is provided wherein the reverse side of the arbor 45 is shown. The arbor 45 includes radially extending ear portions 47a, 47b, the extended terminal ends of which overlay the flange 48 associated with the web 42 of the gear 41. The rear face or back surface 45a of the arbor 45 (see FIG. 5B) confronting the web 42, includes depending, reinforcing leg portions 49a, 49b. A collar 46a abuts the web 42 of the gear 41 and maintains the remaining portion of the arbor 45 spaced from the web 42 of the gear 41. Also attached to the rear of the back surface 45a of the arbor 45 is a clip 50 which grasps the free standing leg 44b of the spring 44.

Thus one end 44a (FIG. 4) of the spring 44 is connected to the web 42 of the gear 41, while the other end 44b of the spring 44 is connected to the arbor 45 which is in turn keyed



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to the shaft 32 mounted for rotation in and through the sump 33 of the cartridge 30. Therefore the gear 41 is connected to the shaft 32 through the spring 44 and the arbor 45. As the gear 41 rotates, the end 44b of the spring presses against the catch 50 in the arbor 45 which tends to rotate causing the paddle 34 on the shaft 32 to rotate. When the paddle first engages the toner in the sump 33, the added resistance causes an increase in torsion and the spring 44 tends to wind up thereby causing the encoder wheel 31 to lag the rotational position of the gear 41. Stops 51 and 52 mounted on the flange 48 prevent over winding or excessive stressing of the spring 44. In instances where the sump 33 is at the fill design level of toner 35, the ears 47a, 47b engage the stops 52 and 51 respectively. The spring 44 therefore allows the paddle shaft 32 to lag relative to the gear 41 and the drive train 40 because of the resistance encountered against the toner 35 as the paddle 34 attempts to move through the sump 33. The more resistance encountered because of toner against the paddle 34, the greater the lag. As shall be described in more detail hereinafter, the difference in distance traveled by the gear 41 (really the motor 15a) and the encoder wheel 31, as the paddle 34 traverses the sump 33 counter clockwise from the 9:00 position (see FIG. 2), to about the 5:00 position, is a measure of how much toner 35 remains in the sump 33, and therefore how many pages may yet be printed by the EP machine or printer 10 before the cartridge 30 is low on toner. This measurement technique will be explained more fully with regard to finding the home position of the encoder wheel 31 and reading the wheel.

Turning now to FIG. 6 which is a simplified electrical diagram for the machine 10, illustrating the principal parts of the electrical circuit thereof, the machine employs two processor (micro-processor) carrying boards 80 and 90, respectively labeled "Engine Electronics Card" and "Raster Image Processor Electronics Card" (hereinafter called EEC and RIP respectively). As is conventional with processors, they include memory, I/O and other accouterments associated with small system computers on a board. The EEC 80, as shown in FIG. 6, controls machine functions, generally through programs contained in the ROM 80a on the card and in conjunction with its on-board processor. For example, on the machine, the laser printhead 82; the motor transport assembly 15; the high voltage power supply 83 and a cover switch 83a which indicates a change of state to the EEC 80 when the cover is opened; the Encoder Wheel Sensor 31a which reads the code on the encoder wheel 31 informing the EEC 80 needed cartridge information and giving continuing data concerning the toner supply in the sump 33 of the EP cartridge 30; a display 81 which indicates various machine conditions to the operator, under control of the RIP when the machine is operating but capable of being controlled by the EEC during manufacturing, the display being useful for displaying manufacturing test conditions even when the RIP is not installed. Other functions such as the Erase or quench lamp assembly 84 and the MPT paper-out functions are illustrated as being controlled by the EEC 80. Other shared functions, e.g., the Fuser Assembly 86 and the Low Voltage Power Supply 87 are provided through an interconnect card 88 (which includes bussing and power lines) which permits communication between the RIP 90 and the EEC 80, and other peripherals. The Interconnect card 88 may be connected to other peripherals through a communications interface 89 which is available for connection to a network 91, non-volatile memory 92 (e.g., Hard drive), and of course connection to a host 93, e.g., a computer such as a personal computer and the like.

The REP primarily functions to receive the information to be printed from the network or host and converts the same

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to a bit map and the like for printing. Although the serial port 94 and the parallel port 95 are illustrated as being separable from the RIP card 90, conventionally they may be positioned on or as part of the card.

Prior to discussing, via the programming flow chart, the operation of the machine in accordance with the invention, the structure of the novel encoder wheel 31 should be described. To this end, and referring now to FIG. 7, the encoder wheel 31 is preferably disk shaped and comprises a keyed central opening 31b for receipt by like shaped end 32a of the shaft 32. The wheel includes several slots or windows therein which are positioned preferably with respect to a start datum line labeled D0, for purposes of identification. From a "clock face" view, D0 resides at 6:00, along the trailing edge of a start/home window 54 of the wheel 31. (Note the direction of rotation arrow 34a.) The paddle 34 is schematically shown positioned at top-dead-center (TDC) with respect to the wheel 31 (and thus the sump 33). The position of the encoder wheel sensor 31a, although stationary and attached to the machine, is assumed, for discussion purposes, aligned with D0 in the drawing and positioned substantially as shown schematically in FIG. 1.

Because the paddle 34 is generally out of contact with the toner in the sump, from the 3:00 position to the 9:00 position (counter clockwise rotation as shown by arrow 34a), and the shaft velocity may be assumed to be fairly uniform when the paddle moves from at least the 12:00 (TDC) position to the 9:00 position, information concerning the cartridge 30 is preferably encoded on the wheel between 6:00 and approximately the 9:00 position. To this end, the wheel 31 is provided with radially extending, equally spaced apart, slots or windows 0-6, the trailing edges of which are located with respect to D0 and labeled D1-D7 respectively. Each of the slots 0-6 represents an information or data bit position which may be selectively covered as by one or more decals 96, in a manner to be more fully explained hereinafter with reference to FIG. 10. Suffice at this point that a plurality of apertures 56-59 are located along an arc with the same radius but adjacent the data slots or windows 0-6. Note that the spacing between apertures 56 and 57 is less than the spacing between apertures 58 and 59.

The coded data represented by combinations of covered, not-covered slots 0-6 indicate to the EEC 80 necessary information as to the EP cartridge initial capacity, toner type, qualified or unqualified as an OEM type cartridge, or such other information that is either desirable or necessary for correct machine operation. Adjacent slot 6 is a stop window 55 which has a width equal to the distance between the trailing edges of adjacent slots or windows, e.g.,  $D1=(D2-D1)=(D3-D2)$  etc.)=the width of window 55. Note that the stop window 55 is also spaced from the trailing edge of slot 6 a distance equal to the stop window width 55. That is, the distance  $D8-D7$ =twice the window 55 width while the window width of window 55 is greater than the width of the slots 0-6.

Adjacent slot 0, from approximately the 5:00 to the 6:00 position is a start/home window 54. The start/home window 54 is deliberately made larger than any other window width. Because of this width difference, it is easier to determine the wheel position and the start of the data bit presentation to the encoder wheel sensor 31a. The reason for this will be better understood when discussing the programming flow charts of FIGS. 8A and 8B.

In order to provide information to the EEC 80 as to the lag of the encoder wheel 31 relative to the transport motor 15a position (counted increments), three additional slots or win-

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dows "a", "b" and "c" are provided at D9, D10 and D11 respectively. The trailing edge of slot "a", (angular distance D9) is 200° from D0; the trailing edge of slot "b" (angular distance D10) is 215° from D0 and the trailing edge of slot "c" (angular distance D11) is 230° from D0. From FIG. 7 it may be seen that when the slot "a" passes the sensor 31a at D0, the paddle 34 will have already passed bottom dead center (6:00 position) by 20°, (200°-180°); window or slot "b" by 35° (215°-180°), and slot "c" by 50° (230°-180°). The significance of the placement of the slots "a", "b" and "c" will be more fully explained, hereinafter, with respect to FIG. 9.

Referring now to FIGS. 8A and 8B which shows respectively a programming and functional flow chart illustrating the code necessary for machine start up, and the reading of information coded on the encoder wheel, including the measurement of toner 35 level in the toner sump 33. At the outset, it is well that it be understood that there is no reliance on or measurement of the speed of the machine, as it differs depending upon the operation (i.e., resolution; toner type; color etc.) even though a different table may be required for look up under gross or extreme speed change conditions. Accordingly, rather than store in the ROM 80a a norm for each of several speeds to obtain different resolutions to which the actual could be compared to determine the amount of toner left, what is read instead is the angular 'distance' traversed by the encoder wheel 31 referenced to the angular distance traveled by the motor, and then comparing the difference between the two angular measurements to a norm or base-line to determine the amount of toner 35 left in the sump 33. By observation, it can be seen that the distance that the encoder wheel travels between start or home (D0) and "a", "b", "c" is always the same. So what is being measured is the distance the motor has to travel before slot "a" is sensed, slot "b" is sensed and slot "c" is sensed, and then taking the difference as being the measured lag. In essence, and perhaps an easier way for the reader to understand what is being measured, is that the angular displacement of the paddle 34 is being measured with respect to the angular displacement of the gear 41 (gear train 40 as part of transport motor assembly 15). As discussed below, the greatest number (lag number) indicates the paddle position which gives the highest torque (the most resistance). This number indicates which look up table in ROM should be employed and gives a measure of how much toner 35 is left in the sump 33 of the cartridge 30.

Referring first to FIG. 8A, after machine 10 start up or the cover has been opened and later closed, the Rolling Average is reset, as shown in logic block 60. Simply stated, 'n' (e.g., 5 or 6) sample measurements are examined and the average of them is stored and the code on the encoder wheel 31 of the cartridge 30 is read, compared to what was there before, and then stored. The reason for doing this is that if a user replaces an EP cartridge since the last power on or machine 10 startup, there may be a different toner type, toner level etc. in the new sump. Accordingly, so as not to rely on the old data, new data is secured which includes new cartridge data and/or amount of toner 35 remaining in the cartridge 30. Therefore a new 'rolling average' is created in the EEC 80. With regard to host notification, however, the old data would be reported because the great majority of time when the machine is started up or the cover is closed once opened, a new cartridge will not have been installed, and reliance may usually be placed upon the previous information.

The next logical step at 61 is to 'Find the Home position' of the encoder wheel 31. In order for either the toner level or cartridge characteristics algorithms to operate properly,

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the "home position" of the wheel 31 must first be found. Necessarily, the EEC 80, through sensor 31a must see the start of a window before it begins determining the home or start position of the wheel, since the engine could be stopped in, for instance, the stop window 55 position and due to backlash in the system, the motor may move enough distance before the encoder wheel actually moves that the measured "total window width" could appear to be the start/home window 54. Below is set forth in pseudo code the portion of the program for finding the start/home window 54. As previously discussed, the start/home window 54 is wider than the stop window 55 or for that matter, any other slot or window on the encoder wheel 31.

```

15 'Find the home window first
   ' This loop runs on motor "increments"
   HomeFound = False
   while ( ! HomeFound)
   If (found the start of a Window) Then
     WindowWidth = 0
20   While (not at the end of Window) {increment WindowWidth}
     If (WindowWidth > MINIMUM_HOME_WIDTH
       AND WindowWidth < MAXIMUM_HOME_WIDTH) Then
       HomeFound = True
   End if
   End While

```

In the above algorithm, 'HomeFound' is set false and a loop is run until the window or slot width meets the conditions of greater than minimum but less than maximum, then 'HomeFound' will be set true and the loop is ended. So the algorithm in essence is articulating: see the window; compare the window with predetermined minimum and maximum widths, for identification; and then indicate that the 'home window' 54 has been found when those conditions are met.

To ensure that the algorithm found home properly, after it identifies the stop window 55, it checks to ensure that the position of the stop window 55 is within reason with respect to the start/home window 54 and of course that the window width is acceptable. This occurs in logic blocks or steps 62, 63 and 64 in FIG. 8A. If this condition is not met, then the configuration information should be taken again. If this check passes, then there is no need to continue to look at the configuration information until a cover closed or power on cycle occurs. This guards against the potential conditions wherein the engine misidentifies the start/home window 54 and thus mis-characterizes the cartridge 30.

Prior to discussing the pseudo-code for 'Reading the Wheel', it may be helpful to recall that a portion of the encoder wheel's 31 revolution is close enough to constant velocity to allow that section to be used and read almost as a "windowed bar code". With reference to FIG. 7, that is the section of the wheel 31 from the trailing edge of the start/home window 54 to the trailing edge of the stop window 55 including the slots or windows 0-6. This is preferably in the section of the encoder wheel 31 in which the paddle 34 is not impinging upon or in the toner 35 in the sump 33. Passage of this section over the optical sensor 31a creates a serial bit stream which is decoded to gather read-only information about the cartridge. The information contained in this section may comprise information that is essential to the operation of the machine with that particular EP cartridge, or "nice to know" information. The information may be divided, for example into two or more different classifications. One may be cartridge 'build' specific, i.e., information which indicates cartridge size, toner capacity, toner type, photo conductor (PC) drum type, and is person-



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alized when the cartridge is built, the other which may allow for a number of unique "cartridge classes" which may be personalized before cartridge shipment, depending, for example, upon the OEM destination. The latter classification may, for example inhibit the use of cartridges from vendors where it is felt that the cartridge will give inferior print, may have some safety concern, or damage the machine in some way. Alternatively, if the machine is supplied as an OEM unit to a vendor for his own logo, the cartridges may be coded so that his logo cartridge is that which is acceptable to the machine. The selective coding by blocking of the windows may be performed via a stick-on-decal operation which will be more fully explained with reference to FIG. 10.

The 'Find Home' code determines the start/home window 54 and measures the distance corresponding to the trailing edge of each window 0-6 from the trailing edge of the window 54. This acquisition continues until the engine detects the stop window 55 (which is designed to have a greater circumferential width than the data windows 0-6 but less than the start/home window 54). Using a few integer multiplications, the state of each bit in the byte read is set using the recorded distance of each window 0-6 from the trailing edge of the home window 54.

The portion of the program for reading the encoder wheel, in pseudo-code, is as follows:

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'Find Home' (see above)
' Gather distances for all of the data window
' This loop runs on motor "increments"
Finished = False
WindowNumber = 0
CumulativeCount = 0
while (!Finished)
CumulativeCount = CumulativeCount + 1
If (the start of a window is found) Then
  WindowWidth = 0
  While (not at the end of Window)
    increment WindowWidth
    increment CumulativeCount
  End While
  If (WindowWidth > Minimum Stop window Width
  AND WindowWidth < Maximum Stop Window Width
  AND CumulativeCount > Minimum Stop Position
  AND CumulativeCount < Maximum Stop Position)Then
    'we must ensure that the stop window is really what we found
    Finished = True
    StopDistanceFromHome = CumulativeCount
  Else
    DistanceFromHome(WindowNumber) = CumulativeCount
    WindowNumber = WindowNumber + 1
    End If ' check for stop window
  End If ' check for start of window
End While
' Now translate measurements into physical bits
DataValue = 0
' First divide the number of samples taken by 9
BitDistance = StopDistanceFromHome / 9
For I = 0 To WindowNumber - 1
  BitNumber = DistanceFromHome(I) / BitDistance
  'What is being determined is the bit number corresponding to the
  ' measurement by rounding up DistanceFromHome(I)/BitDistance.
  If DistanceFromHome(I) - (BitDistance * BitNumber)) * 2 > BitDistance) Then
    BitNumber = BitNumber + 1
  End If
  DataValue = DataValue + 1 (SHIFLEFT) BitNumber - 1
Next ' Window number
DataValue = -DataValue 'invert result since windows are logic 0's

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data bit, and stop bit trailing edge, as was discussed with regard to FIG. 7 that the distances D1-D7 between the trailing edges of windows or slots 0 through 6, are equally spaced. (i.e., D7-D6=some constant "K", D5-D4=constant "K" etc.) The trailing edge of the stop window 55 is also a distance of twice "K" from the trailing edge of slot 6. While the distance from the trailing edge of stop window 55 to its leading edge (i.e., the window 55 width) is equal to one 'bit' distance or "K" from the leading edge, this width may be any convenient distance as long as its width is > than the width of the slots 0-6 and < the width of the start/home window 54. Thus the line of pseudo code above 'First divide the number of samples taken by 9', (from the trailing edge of the start/home window or slot 54) means that there are 7 bits from D1 through D7, plus two more through D8, and therefore '/9' gives the spacing "K" between the windows (trailing edge of the start/home window 54 to the trailing edge of the stop window 55) which may be compared to what this distance is supposed to be, and in that manner insure that the bit windows 0-6 and stop window 55 have been found. If the stop window 55 is not identified correctly by the technique just described, then a branch from logic step 64 to logic step 61 will once again initiate the code for finding the home position, as in block 61 and described above.

In logic block or step 65, the next logical step in the program is to go to the Data Encoding Algorithm portion of

The program depicted above in pseudo code for reading the wheel is quite straight forward. Thus in logic step 63, (FIG. 8A) where the motor increments are recorded for each

the program. In the pseudo code set forth above, this starts with the REM statement "'Now translate measurements into physical bits'". Now, assume that when coded, the encoder

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wheel 31 has several of the bits 0-6 covered, as by a decal so that light will not pass therethrough. Suppose all data bit slots but 6 and the stop window 55 are covered. A reading of distance D8/9 will give the spacing between the data slots or windows 0-6. Therefore, the distance to slot D7, i.e., the trailing edge of slot 6, will be 7 times "K" (bit spacing) and therefore will indicate that it is bit 7 that is emissive and that the bit representation is 1000000, or if the logic is inverted, 0111111. Notice that the number found is rounded up or down, as the case may be dependent upon such factors as paddle mass, rotational speed etc. In certain instances, this may mean rounding up with a reading above 0.2 and rounding down with a reading below 0.2. For example, 6.3 would be rounded to 7, while 7.15 would be rounded to a 7.

In logic step 66 the question is asked: "Does the machine stop during paddle rotation?" If it does, logic step 67 is initiated. The reason for this is that if the paddle is stopped, especially when in the portion of the sump 33 containing a quantity of toner 35, in order to release the torsion on the spring 44 the motor 15a is backed up several increments. This will allow removal, and/or replacement, if desired, of the EP cartridge 30. This logic step allows for decrementing the number of steps "backed up" from the incremental count of motor increments which was started in logic block 62.

Turning now to FIG. 8B, as the encoder wheel 31 rotates, the paddle 34 enters the toner in the sump 33. As described above relative to logic step 62, the motor increments are counted. The motor increments are then recorded as S200, S215 and S230, in logic step 68a, 68b and 68c at the trailing edges of slots "a", "b", and "c" respectively of the wheel 31. These numbers, S200, S215 and S230 are subtracted from the baseline of what the numbers would be absent toner 35 in the sump 33, (or any other selected norm) which is then directly indicative of the lag due to resistance of the toner in the sump, with the paddle 34 in three different positions in the sump. This is shown in logic steps 69a-69c respectively. As has previously been stated, there is a correlation between load torque on the toner paddle 34 and the amount of toner 35 remaining in the toner supply reservoir or sump 33. FIG. 9 illustrates this relationship. In FIG. 9, torque is set in inch-ounces on the ordinate and degrees of rotation of the paddle 34 on the abscissa.

Referring briefly to FIG. 9, several characteristics of this data stand out as indicating the amount of toner remaining. The first one is the peak magnitude of the torque. For example, with 30 grams of toner 35 remaining in the sump 33, the torque is close to 2 inch-ounces, while at 150 grams the torque approximates 4 inch-ounces and at 270 grams the torque approximates 8 inch-ounces. The second characteristic is that the location of the peak of the torque curve does not move very much as the amount of toner changes. This suggests that measuring the torque near the location where the peak should occur could provide a measure of remaining toner. That is why, as shown in FIG. 7, the trailing edge of slot "a", (distance D9) is 200° from D0; the trailing edge of slot "b" (distance D10) is 215° from D0 and the trailing edge of slot "c" (distance D11) is 230° from D0. Another obvious indicator is the location of the onset of the torque load. Yet a third indicator is the area under the torque curves.

Another way of looking at this process is that while the angular distance measurements of D9, D10 and D11 are known, the number of increments the motor has to turn in order that the resistance is overcome as stored in the torsion spring 44, is the difference in distance the motor has to travel (rotational increments) to obtain a reading at window "a", then "b" and then "c". The delay is then compared as at logic step 70 and 71, and the largest delay is summed as at logic

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steps 72, 73 or 74 to the rolling average sum. Thereafter a new average calculation is made from the rolling average sum. This is shown in logic step 75. As illustrated in logic block 76, the toner 35 level in the sump 33 may then be determined from a look up table precalculated and stored in the ROM 80a associated with the EEC 80 in accordance with the new rolling average.

In logic block 77, the oldest data point is subtracted from the rolling average sum and then the rolling average sum is reported for use back to logic block 61 (Find Home position). If the toner level changed from the last measurement, as in compare logic block 78, this condition may be reported to the local RIP processor 90 and/or the host machine, e.g., a personal computer as indicated in logic block 79.

Coding of the encoder wheel 31 is accomplished, as briefly referred to above, by covering selected ones of slots 0-6 with a decal. For customization for an OEM vendee, and in order to reduce inventory, and in accordance with another feature of the invention, the problem of quickly and accurately applying such a decal to the correct area of the wheel 31, even under circumstances of limited space, is provided. Due to the close spacing of the slots 0-6 in the encoder wheel 31, a pre-cut, preferably adhesive backed decal 96 is employed to selectively cover pre-selected slots depending on how the decal is cut or stamped. Very accurate positioning of the decal 96 is achieved by use of alignment pins in conjunction with an alignment tool 100. Because another decal can be placed on another region of the wheel, the spacing of the alignment holes 56-59 on the encoder wheel 31 is different in each region.

To this end, as previously discussed, there are two pairs of apertures in the encoder wheel or disk, adjacent the slots, the apertures of one of the pairs 58, 59 being spaced apart a greater distance than the apertures 56-57 of the other of the pairs. Referring now to FIG. 10, a decal 96 is sized to fit over at least one of the slots 0-2, or 3-6 to cover the same. As illustrated, the decal 96 has spaced apart apertures therein corresponding to one of the pairs of apertures, i.e., 58, 59 or 56, 57. A tool 100 has a pair of pins 97, 98 projecting therefrom and corresponding to the spacing of one of the pairs of apertures, whereby when the apertures in the decal are mated with the projecting pins of the tool, the projecting pins of the tool may be mated with the one pair of apertures in the encoder wheel or disk to thereby accurately position the decal over the selected slot in the disk. The decal 96 is installed on the tool with the adhesive side facing away from the tool. The tool 100 is then pushed until the decal 96 makes firm contact with the surface of the wheel.

If the pins 97 and 98 are spaced equal to the spacing between apertures 56 and 57, the decal cannot, once on the tool 100, be placed covering slots associated with the incorrect apertures 58 and 59. The opposite condition is also true. Accordingly, two such tools 100 with different pin 97, 98 spacing may be provided to insure proper placement of the correct decal for the proper slot coverage. Alternatively, a single tool 100 with an extra hole for receipt of a transferred pin to provide the correct spacing, may be provided.

This method of selective bit blocking is preferred because the process is done at the end of the manufacturing line where less than all of the wheel 31 may be exposed. Use of this tool 100 with differing spaced apart pins allows the operator to get to the encoder wheel 31 easily and prevents misplacement of the decal.

FIGS. 11A-11E are directed to refinements in the method of the invention depicted in FIGS. 8A and 8B. Such refine-

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ments include, for example, improvements in the code to further reduce the incidence of mistakes in location of the stop window 55 (or stop bit). As shown in FIG. 11A in comparison to FIG. 8A, additional steps 160, 161, and 162, are present, wherein further logic associated with step 161 is depicted in FIG. 11C and further logic associated with step 162 is depicted in FIG. 11D. Furthermore, shown in FIG. 11B in comparison to FIG. 8B, and continuing into FIG. 11E, is a presently more preferred manner of determining, with somewhat greater accuracy, the amount of toner remaining in the sump (toner level) regardless of the speed of rotation of the paddle 34 and associated encoded plate, or encoder wheel, 31. In the following discussion, functional steps depicted in FIGS. 11A–11E which are common, or substantially similar, to those functional steps of FIGS. 8A and 8B will bear the same element numerals, and the detail of those common steps will not be repeated below.

As shown in FIGS. 8A and 8B, the steps associated with reading of the preselected cartridge characteristics and the steps associated with determining the toner level in sump 33 are performed in parallel. With respect to FIG. 11A and 11B, however, as shown at step 160, such parallel processing continues until the decoding of the preselected cartridge characteristics is successful, and thereafter, only the steps associated with determining the toner level in sump 33 (steps 66 and 67 of FIG. 11A, and the steps of FIGS. 11B and 11E) are performed. Such preselected cartridge characteristics may include, for example, initial cartridge capacity, toner type, PC drum type, qualified or unqualified as an OEM type cartridge, etc. One skilled in the art will recognize that such parallel processing may be achieved in a variety of ways, such as for example, by interleaving the program steps of the parallel paths within a single processor or by using a separate processor for each path.

Referring now to 11A, after machine 10 is started up, or after the printer cover has been opened and later closed, the variable identified as a “Rolling Average” is reset at step 60. The resetting of the Rolling Average occurs prior to executing the steps associated with reading the coding representing preselected cartridge characteristic from wheel 31, i.e., steps 61, 62, 160, 63, 161, 64, 65, and 162, and prior to determining the amount of toner remaining in sump 33 of cartridge 30 beginning at step 66, and continuing into FIGS. 11B and 11E.

In order for either the preselected cartridge characteristics steps or the toner level determining steps to operate properly, the “home position” of the wheel 31 must first be found, as at step 61. The previous discussion concerning the encoder wheel 31 and the reading thereof to determine the home position of wheel 31 is equally applicable to the refinements depicted in FIGS. 11A–11E. Moreover, the pseudo code for “Reading the Wheel”, discussed above is equally applicable for reading the encoder wheel, except that the portion of the code relating to the window width may be simplified, as follows:

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If (WindowWidth > Minimum Stop window Width
    AND CumulativeCount < Maximum Stop Position)Then
    ' we must ensure that the stop window is really what we found
    Finished = True
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At step 62, the counting of increments of shaft rotation of the drive motor begins at the position associated with the trailing edge of start/home window 54. Thereafter, at step 160, a check is made as to whether the coding representing preselected cartridge characteristics was successfully

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decoded. If this preselected cartridge characteristics coding was not successfully decoded, then the parallel processing of the preselected cartridge characteristics and the determination of toner level continues; if so, however, such parallel processing ends, and only those steps associated with determining the toner level in cartridge 30 are performed.

During the decoding of the preselected cartridge characteristics of wheel 31, at step 63, the number of motor increments from the trailing edge of the start window 54 to each of the data bit windows 0–6 and stop window 55, respectively, are recorded. Thereafter the steps of FIG. 11C are performed.

Turning now to FIG. 11C, a check is made at step 165 to determine if more than 7 bits have been seen between the home window 54 and the stop window or bit 55. If yes, then step 61 is re-executed and the home position is once again found. This test to detect and determine the presence or absence of an excess of a finite number of slots or bits on the encoder wheel 31 is preferred because as the wheel rotates, causing the sensor to detect either a transition from open to closed state or vice-versa, bounce may occur. If the bounce duration is very small, it will be rejected as a window (slot), otherwise it may pass and be considered a valid window. In such a scenario, certain cartridges may appear to have more bit windows than physically possible. After each bit window is detected, the number of bit windows detected from the previous home detection is compared to a maximum value and if too many windows have been detected, then the code returns to the steps for finding the home state via path 194.

Another condition that can occur which makes a further check desirable is when the sensor signal transitions from one state to the other and immediately back to the original state, resulting in the indication of a detection of an additional, or redundant, window. A test for such a condition is performed at step 166. As shown in FIG. 7, and as has already been discussed, bit or slot distances on the wheel are known and mapped. The identification of what appears to be two bits or slots in the same region on wheel 31 is identified as an error in reading the preselected cartridge characteristics for that particular revolution of wheel 31, and results in a return to re-execute of step 61 of FIG. 11A via path 194.

Referring again to FIG. 11C, step 167 is performed so as to assure that the code bits 0–6 are not mistaken for the stop bits. Thus, at step 167 the number of motor increments counted is compared to a predefined maximum number of such increments associated with the distance between the trailing edge of home window 54 and the trailing edge of stop window 55. If the number of motor increments is not less than the predefined maximum number, then via return loop 194, step 61 of FIG. 11A is re-entered and this loop continues until a correct reading is achieved, or until an error code indicates a fatal error to the machine operator. If the number of motor increments is equal to or greater than the predetermined maximum number, then step 168 is executed, wherein it is determined whether the measured window or slot width is greater than the minimum stop width. If not, then step 63 is re-entered via path 184. In the event that the stop window 55 width is greater than the slot window width, then a check is made at step 169 to determine whether the duration (in motor increments) of closure of the reader/sensor is a sufficient number of increments to indicate a reading of stop window 55 versus the last bit read, for example, slot 6. If slot 6 is covered, the distance or closure reading will be even longer. In the event that closure of the sensor has not occurred for a sufficient period of time, then loop 184 line is again entered and logic step 63 is once again initiated. In the event that the closure of the sensor has



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occurred for a sufficient period of time, then step 65 of FIG. 11A is executed.

To further insure accurate reading of the encoder wheel 31, spring 44 is preloaded to a known torque value. Preferably, this preload value is as small as possible to allow for accurate reading of low levels of toner in sump 33. The preload may be achieved by, for example, providing an adjustable tab stop in place of either or both tabs 51 and 52 of FIG. 4. Such an adjustable tab stop can be, for example, a rotatable eccentric stop.

Step 65 is directed to the actual decoding of the preselected cartridge characteristic coding of encoder wheel 31, the details of which are more fully described with respect to the steps of FIG. 11D, which constitute step 162 of FIG. 11A. In the pseudo code set forth above, this starts with the REM statement "Now translate measurements into physical bits", and the discussion concerning distances and rounding applies. In table 170 of FIG. 11D, which may be referred to as a 'loop table', logic is utilized in a loop for each reading D1-D7 of the code wheel 31 (see FIG. 7), and takes into account the rounding discussed heretofore. Note that the "code registered" is the code which would be read at each of the respective bit positions corresponding to windows or slots 0-6, wherein a "1" represents an open slot at the respective bit position. The final code is a result of ANDing each column of bits in the seven "code registered" entries. For example, if none of the slots or windows is covered, then the final code reading will be 111111; if slot 0 (FIG. 7) is covered, then the reading will be 111110; and, if slot 2 is also covered, then the reading will be 111010. Of course, such binary representations may be inverted such that a "1" represents a covered slot, rather than a "0".

The code read from the loop table 170 is then interpreted by a look up table at logic step 171 and the interpreted code is then sent to the EEC 80 in logic step 172. By a logical comparison, if the code is the same as that which is stored in NVRAM in EEC 80, as indicated in step 173, no further reading of the code is necessary and the decoding of the preselected cartridge characteristic coding of encoded plate, or wheel, 31 is ended until the next occurrence of machine start-up or machine cover cycling. To decrease decode time, after the same code has been read consecutively twice, this code is stored in the NVRAM (logic step 175) for future comparisons and the steps for decoding the coding representing the preselected cartridge characteristic information is ended. In the event that the code has not been read twice, a counter is set with a "1", and as shown in logic step 174, the path via line 194 (FIG. 11A) is entered for re-reading the code beginning at step 61 of FIG. 11A.

Once the decoding of the preselected cartridge characteristic coding is completed, the logic at step 160 then ignores further preselected cartridge characteristic code reading of wheel 31, and the method turns to solely reading the delay bits "a", "b", and "c", as discussed hereinafter relative to FIG. 11B, in determining the amount, or level, of toner in sump 33 of cartridge 30. In the presently preferred configuration of the encoder wheel 31, the trailing edge of slot "a", (angular distance D9) is 182° from D0; the trailing edge of slot "b" (angular distance D10) is 197° from D0 and the trailing edge of slot "c" (angular distance D11) is 212° from D0.

Referring again to FIG. 11A, the explanation for the logic steps 66 and 67 is the same as set forth heretofore and will not be repeated here. However, in further explanation, when reverse motion is detected a counter counts the number of back increments or steps and that same number is applied or

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subtracted as the motion is reversed to forward so that the count is resumed when the wheel begins its forward motion again. For example, in a single page print job, the encoder wheel will stop before a full revolution is complete. The machine will run the transport motor in reverse for a short distance after each stop in order to relieve pressure in the gear train. As set forth above, this permits, if desired, cartridge removal and/or replacement. Without correction, this could induce a considerable error in measurement of toner level. To account for this, the amount of excess motor pulses counted during the backup and restart are filtered out of the delay counts measured for toner level sensing.

Turning now to FIG. 11B, as has been explained heretofore with reference to FIG. 8B, as encoder wheel 31 rotates, paddle 34 enters toner 35 in sump 33. As set forth heretofore with reference to FIG. 8B, the angular distances of D9, D10 and D11 are known, and the number of no-load motor increments required to reach D9, D10 and D11 is known. The motor, via torsion spring 44, rotates paddle 34 and encoder wheel 31. As paddle 34 moves through toner 35, however, a paddle-to-toner resistance is incurred, which results in a torsioning of torsion spring 44, since the motor is essentially rotating at a constant rate. Thus, the actual number of motor increments required to reach each of the respective locations D9, D10, and D11 is greater during a load condition when paddle 34 engages an amount of toner than when a lesser amount or no toner is engaged. This difference in the distance the motor has to travel (rotational increments) to obtain a reading at window "a", then "b" and then "c" corresponds to a level of toner in sump 33.

As described above relative to logic step 62 (FIG. 11A), the motor increments are counted. The motor increments are then recorded as S200, S215 and S230 in steps 68a, 68b and 68c (FIG. 11B) at the trailing edges of slots "a", "b", and "c", respectively, of the wheel 31, and subtracted from the baseline of what the numbers would be absent toner 35 in the sump 33, at steps 69a, 69b, and 69c, respectively. These numbers are directly indicative of the lag due to resistance of the toner in sump 33, with the paddle 34 in three different positions (a, b, and c) in the sump. Thus, this lag or delay is determined and shown in steps 69a-69c, respectively. As has been previously stated, there is a correlation between load torque on the toner paddle 34 and the amount of toner 35 remaining in the toner supply reservoir or sump 33. (See FIG. 9 and the discussion relating thereto.)

At steps 70 and 71, the respective baseline normalized delays are compared, and one of the three delays is selected for use in determining the toner level of cartridge 30 at the then current printer operating speed in pages per minute (ppm) at steps 72', 73' or 74'. As shown in FIG. 11B at step 70, the normalized delay @200 will be used to calculate the toner level unless its value is not greater than that of normalized delay @215. If the normalized delay @200 is less than or equal to normalized delay @215, then at step 71 it is determined whether normalized delay @215 is greater than normalized delay @230. If so, then the normalized delay @215 is used, and if not, then normalized delay @230 is used in the toner level determination. Alternatively, a maximum normalized delay figure can be used in the toner level calculation.

Preferably, the normalized delay selected in the toner level determination is sent to an equation for calculating the toner level mass (in grams of toner) at a particular machine speed in pages per minute (ppm). The equation to determine, at different ppm printing speeds, the mass in grams of toner remaining in the cartridge is the linear equation:  $y=mx+b$  where:

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$m$ =slope measured in grams/pulse (or increments);  
 $b$ =y axis intercept, or offset, where  $x=0$  grams; and  
 $x$ =average number of pulses, or increments.

The values for variables  $m$  and  $b$  are essentially constants with respect to various printing speeds. These values may be determined empirically, or calculated or determined based upon assumptions. For example, the following table represents the values for variables  $m$  and  $b$ , assuming 10.80 motor pulses per degree of encoder wheel rotation.

| 8 ppm |     | 12 ppm |     | 18 ppm |     | 24 ppm |     |
|-------|-----|--------|-----|--------|-----|--------|-----|
| $m$   | $b$ | $m$    | $b$ | $m$    | $b$ | $m$    | $b$ |
| .18   | 55  | .19    | 52  | .21    | 48  | .23    | 45  |

Using the above table, for example, for an 8 ppm operating speed, the equation above becomes:  $y=0.18x+55$ . Accordingly, if  $x=100$ , then it is determined that 73 grams of toner remain in sump 33.

It has been found that with a single speed machine, i.e., one that runs at a single speed of rotation of the drum, a rolling average of the delays measured permits calculating toner level, in grams, from the outcome of that average. Under those limited circumstances, the toner level in the sump 33 may then be determined from a look up table precalculated and stored in the ROM 80a associated with the EEC 80 in accordance with the new rolling average. Many printers, however, are capable of multiple resolutions which may require different motor speeds, e.g., 300 dpi (dots per inch), 600 dpi, 1200 dpi, etc., which means that this manner of determining the amount of toner left in the cartridge would be accurate for only one speed. Moreover, delay is a function of both paddle velocity and toner level. In the instance where a printing job requires alternate printing at 600 and 1200 dpi, the machine runs at a different speed for each of these resolutions, and the toner level measurement is difficult to determine by the rolling average method because the rolling average contains delays measured at all of those speeds. To account for this, the rolling average is taken of a velocity independent parameter, i.e., grams. The equation given above converts the measurements of maximum delays immediately to grams, as in logic step 76'. The rolling average is then taken of grams, a speed independent parameter, and therefore velocity changes will not affect the toner level measurement. This is shown in logic step 75'.

Following step 75', the steps of FIG. 11E are performed in preparing to report a toner level or toner low indication, for example, to the EP machine and/or an attached computer. At step 176, the first value of the rolling average from logic step 75' is stored. Subsequent values are stored as AVG2 for comparison to MINAVG. In decision step 177, the value for the rolling average (AVG2) is compared to the previous value MINAVG. If AVG2 is not less than MINAVG, (which would be the normal situation), AVG2 is cleared in logic step 179, and AVG2 is reset with the next value of the rolling average. If the comparison is affirmative, then a further test is performed at step 178 to determine whether the difference between the two readings is logical. If the difference is less than 30 (grams), then the reading is considered logical. If, on the other hand, the difference is greater than or equal to 30, then the reading is discarded as being noise and once again logic block 179 is entered for clearing AVG2 and resetting it with the next value of the rolling average. If the comparison value is less than 30 at step 178, then MINAVG is set equal to AVG2 at step 180 and sent to steps 179 and 181 in parallel. Depending upon the machine, it has been discov-

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ered that it may be desirable to add a scale factor to MINAVG, such as for example, a scale factor (SF) of 3 grams, as is shown at step 181.

The amount of toner held in the sump 33 of a cartridge 30 can vary. Standard toner quantity, measured in grams for a full cartridge, is approximately 400 grams. A user would prefer to know how much is left for use in the machine, e.g., is the sump 33 is half full,  $\frac{3}{4}$  full, or  $\frac{1}{8}$  full, and this is achieved at step 182. The result of step 181, i.e., MINAVG+3 grams, is looked up in the ROM 80a of the EEC card 80 (see FIG. 6). Moreover, as shown in logic step 182, if the toner level increases (as it occasionally does due to noise and unless the cartridge has been replaced since the last measurement), this reading is ignored and the previous toner level is posted as the current level. At step 79', the ROM output returns a sump level to the local machine processor for a direct reading on a printer display, or it sends the reading to the host computer.

Thereafter, the process returns to step 77' of FIG. 11B, in which the oldest delay value from the five held in generating the rolling average is removed. At step 78', the process then delays X steps, or increments, after the first toner level slot before searching for the "home position", i.e., before returning to step 61 of FIG. 11A. The number of steps, X, is chosen to ensure that the third toner level slot has passed the sensor. Thereafter, steps 62, 160, 66, of FIG. 11A are completed, and the steps of FIGS. 11B, and 11E for determining the toner level in sump 33 of cartridge 30 are repeated.

One skilled in the art will recognize that an encoded plate, such as encoder wheel 31, may be fabricated, for example, by forming slots, or openings, in a material. Such a material is preferably disk-shaped, and may, for example, be made of plastic or metal. Although the disk-shaped design is preferred, other shapes may be used without departing from the spirit of the invention.

Also, one skilled in the art will recognize that the windows, or slots, may be free of any material, or alternatively, filled with a transparent material. In addition, it is contemplated that the encoder 31 could be fabricated, for example, from a transparent material having a coating deposited thereon which defines the coding, such as for example, by defining the edges of each window, and in which the coating does not effectively transfer light impinging on its surface.

FIGS. 12-16 show further illustrative embodiments of an encoded wheel corresponding generally to encoder wheel 31 depicted in FIGS. 1-3, and 7. For example, and referring first to FIG. 12, the encoder wheel 31 may be replaced by an identically slotted wheel 131 composed of a ferromagnetic material. The reader/sensor 131a, in this instance, may include an alternate energy source such as a magnet 132 and the receptor or receiver may comprise a magnetic field sensor, such as a Hall effect device, 133 in place of the optical encoder wheel reader/sensor 31a. In operation, the ferromagnetic material of the encoder wheel 131 blocks the magnetic flux emanating from the permanent magnet 132 except where there are slots 135 in the wheel 131. Either the Hall effect device 133 or the magnet 132 may be attached to one of or both the printer 10 or cartridge 30.

In another example, and referring now to FIGS. 13 and 14, an encoder wheel 231 may be employed in association with another reader/sensor 231a. In this embodiment, in lieu of slots or windows in the wheel, such as in encoder wheels 31 and 131, such slots or windows are replaced with reflective material 235. In this scheme, the encoder wheel reader/sensor 231a includes a light source 232 and light sensor or receiver 233 which is activated as the encoder

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wheel rotates and the light from the light source is reflected from the reflective material 235. In comparing the windows or slots of the encoder wheel 31 and the reflective material 235 of wheel 231, it should be noted that the Start/Home window 54 in FIG. 7 corresponds to the Start/Home window (reflective material) 154 in FIGS. 13 and 14, while the information slots 0 and 1 of the encoder wheel 31 in FIG. 7, correspond to the reflective material 235 at 0' and 1' of FIG. 14. Preferably, the wheel 231 should be made of a non-reflective material to avoid scattered or erroneous readings by the optical reader 233. An advantage of this type of structure is that the reader/sensor 231a need be only on one side of the encoder wheel, simplifying machine and toner cartridge design.

The design of an encoder wheel 331 in FIGS. 15 and 16 may be similar, employing a cam follower actuated reader/sensor 331a. In these embodiments, the encoder wheel 331 includes a circumferentially extending cam surface 340 on the periphery of the encoder wheel, wherein the periphery acts as cam lobes 341 with appropriate cam recesses or depressions 342. In comparing the windows or slots of the encoder wheel 31 and the cam recesses or depressions 342, it should be noted that the Start/Home window 54 in FIG. 7 corresponds to the Start/Home recess 354 in FIGS. 15 and 16, while the information slots 0 and 1 of the encoder wheel 31 in FIG. 7, correspond to the cam recesses 342 at 0' and 1' of FIGS. 15 and 16.

The cam followers 360 and 370 of FIGS. 15 and 16, respectively, may take multiple forms, each cooperating with a reader/sensor 331a. The reader/sensor may take many forms, for example a micro-switch which signals, upon actuation, a change of state; or it may be similar to the reader/sensor 31a or 131a, except that the cam followers act to interrupt the energy source and receptor or receiver associated with their own reader/sensor 331a.

In the embodiment of FIG. 15, the cam follower 360 is formed as a bar or arm 361 pivoted on a shaft 362, which in turn is attached, for example, to an appropriate portion of the cartridge 30. Thus, arm 361 acts in pressing engagement with the cam surface 341 due to the action of biasing spring 365. As shown, the biasing extension spring 365 is connected to one end 363 of the bar or arm 361 and anchored at its other end, preferably, to cartridge 30. The cam engaging terminal end of the arm or bar may include a roller 366 to reduce sliding friction. The opposite or energy interrupter end 364 of the bar or arm 361 is appropriately located for reciprocation about the pivot 362.

In the embodiment of FIG. 16, the cam follower 370 takes the form of a reciprocating bar 371 having a centrally located, cam follower throw limiter slot 372, with locating and guide pins 373 and 374 therein for permitting reciprocation (as per the arrow 379) of the bar 371. As shown, one terminal end 375 of the bar 371, may include a roller 376 for pressing engagement against the cam surface 341. To ensure proper following of the follower 370, a biasing extension spring 377 biases the roller 376 of the bar 371 against the rotating cam surface. As in the embodiment of FIG. 15, the follower bar 371 includes an energy interrupter portion 378 for reciprocation into and out of the path between the energy source and receptor of the reader/sensor 331a.

Thus, the present invention provides a simple yet effective method and apparatus for transmitting to a host computer or machine of a type employing toner, information concerning the characteristics of an EP cartridge. Such information can include continuing data relating to the amount of toner left in the cartridge during machine operation and/or preselected cartridge characteristic information. Still further, the present

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invention provides a simplified, but effective, method and means for changing the initial information concerning the cartridge, which means and method is accurate enough and simple enough to allow for either in field alterations or end of manufacturing coding of the EP cartridge.

Although the invention has been described with respect to preferred embodiments, those skilled in the art will recognize that changes may be made in form and in detail without departing from the spirit and scope of the following claims.

What is claimed is:

1. A cartridge for an electrophotographic machine, comprising:

a sump for carrying an agitator rotatably mounted in said sump for engagement with a toner;

an encoded device coupled to a first end of said agitator; and

a torque sensitive coupling connected to a second end of said agitator, which is connectable to a drive mechanism of said machine;

said encoded device having coding means representing cartridge characteristic information.

2. The cartridge of claim 1, wherein said coding means includes coding readable to indicate a component of resistance to agitator movement through a portion of said sump having toner therein to give an indication of an amount of toner remaining in said sump.

3. The cartridge of claim 2, wherein said encoded device is mounted on one side of said torque sensitive coupling and said drive mechanism of said machine is connected to the other side of said torque sensitive coupling and said component of resistance is determined by the lag between a travel of said drive mechanism in relation to a travel of said encoded device.

4. The cartridge of claim 1, wherein said coding means includes a coding representing preselected cartridge characteristic information.

5. The cartridge of claim 1, wherein said coding means comprises a plurality of coding indicators.

6. The cartridge of claim 5, wherein said plurality of coding indicators represent a plurality of preselected cartridge characteristics.

7. The cartridge of claim 5, wherein said plurality of coding indicators comprise a plurality of slots.

8. The cartridge of claim 5, wherein said plurality of coding indicators comprises a plurality of windows.

9. The cartridge of claim 5, wherein said plurality of coding indicators comprise a plurality of notches.

10. The cartridge of claim 5, wherein said plurality of coding indicators comprise a plurality of reflective areas.

11. The cartridge of claim 5, wherein said coding means is encoded by covering at least one of said plurality of coding indicators.

12. The cartridge of claim 5, wherein said plurality of coding indicators are juxtaposed.

13. An electrophotographic machine comprising a cartridge having a sump for containing a supply of toner material and having a torque sensitive coupling connected to a drive mechanism of said machine, said torque sensitive coupling also being connected to a first end of an agitator for effecting rotation of said agitator within said sump, into, through and out of said toner material, and an encoded device coupled to a second end of said agitator, wherein said encoded device includes coding representing preselected characteristic information for said cartridge.

14. A cartridge for an electrophotographic machine, comprising:

a sump for carrying a quantity of toner;



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a toner agitator mounted in said sump; and

a single encoded plate rotating in relation to said toner agitator, said encoded plate including coding means for determining a quantity of toner in said cartridge.

15. The cartridge of claim 14, wherein said coding means comprises at least one coding indicator.

16. The cartridge of claim 14, wherein said coding means comprises a plurality of coding indicators.

17. The cartridge of claim 16, wherein said coding indicators comprise a plurality of openings in said encoded plate.

18. The cartridge of claim 16, wherein said coding indicators comprise a plurality of notches in said encoded plate.

19. The cartridge of claim 16, wherein said coding indicators comprise a plurality of reflective areas on at least one surface of said encoded plate.

20. The cartridge of claim 16, wherein said coding indicators are juxtaposed around an axis of rotation of said encoded plate.

21. The cartridge of claim 20, wherein said encoded plate comprises an encoder wheel.

22. A cartridge for an imaging apparatus, the improvement comprising an encoded plate having coding means representing preselected cartridge characteristic information.

23. The cartridge of claim 21, wherein said coding means comprises a plurality of coding indicators.

24. The cartridge of claim 23, wherein said coding indicators comprise a plurality of openings in said encoded plate.

25. The cartridge of claim 23, wherein said coding indicators comprise a plurality of notches in said encoded plate.

26. The cartridge of claim 23 wherein said coding indicators comprise a plurality of reflective areas on at least one surface of said encoded plate.

27. The cartridge of claim 23, wherein said coding indicators are serially positioned around an axis of rotation of said encoded plate.

28. The cartridge of claim 27, wherein said encoded plate comprises an encoder wheel.

29. The cartridge of claim 23, wherein said encoded plate is encoded by covering at least one of said plurality of coding indicators.

30. The cartridge of claim 22, wherein said coding means represents a plurality of preselected cartridge characteristics.

31. The cartridge of claim 22, wherein said coding means represents binary data at a plurality of coding positions.

32. The cartridge of claim 22, wherein said encoded plate further comprises coding for determining a quantity of toner carried by said cartridge.

33. A replaceable cartridge for an electrophotographic machine, said cartridge comprising:

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a sump for carrying a quantity of toner;

an agitator mounted for rotation into, through and out of engagement with toner carried within said sump;

an encoded plate coupled to said agitator, said encoded plate being positioned for mating coaction with an encoded plate reader and said encoded plate including code indicating means configured for representing cartridge characteristic information; and

a torque sensitive coupling connected at a first end to said agitator and having a second end for connection to a drive mechanism in said machine, which when said cartridge is installed in said machine, effects rotation of said agitator and encoded plate.

34. The replaceable cartridge of claim 33, wherein said code indicating means comprises a plurality of openings in said encoded plate.

35. An encoded plate reader for reading the encoded plate of claim 34, comprising a light sensor and a light source spaced apart for receiving said encoded plate therebetween, said encoded plate reader detecting the presence and absence of said plurality of openings.

36. An encoded plate reader for reading the encoded plate of claim 34, comprising a magnetic field sensor and a magnet spaced apart for receiving said encoded plate therebetween, said encoded plate reader detecting the presence and absence of said plurality of openings.

37. The replaceable cartridge of claim 33, wherein said code indicating means comprises a plurality of reflective surfaces, and said encoded plate reader comprises a light source and a light sensor for detecting light reflected from said reflective surfaces.

38. The replaceable cartridge of claim 33, wherein said code indicating means comprises a plurality of cam surfaces formed in said encoded plate and arranged to impart a digital representation of information concerning said cartridge, and wherein said reader comprises a cam follower in pressing engagement with said cam surfaces, and a means associated with said cam follower to convey said information to said machine.

39. A method of determining said quantity of toner in said cartridge of claim 33, comprising the steps of:

determining a rotational position of said drive mechanism;

determining a relative position of said encoded plate; and measuring the lag between said rotational position of said drive mechanism and said relative rotational position of said encoded plate.

\* \* \* \* \*



**TO ALL TO WHOM THESE PRESENTS SHALL COME:**

December 31, 2009

**U.S. PATENT: 6,009,291**  
**ISSUE DATE: December 28, 1999**

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US006009291A

**United States Patent** [19][11] **Patent Number:** **6,009,291**

Curry et al.

[45] **Date of Patent:** **Dec. 28, 1999**[54] **CONTROL OF PHOTSENSITIVE ROLLER MOVEMENT**

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[75] Inventors: **Steven Alan Curry**, Nicholasville; **Paul Douglas Horrall**, Lexington; **David Lee Merrifield**, Lexington; **Daniel George Mlejnek**, Lexington; **James John Molloy**, Lexington; **Harald Portig**, Versailles; **Gregory Lawrence Ream**; **Richard Andrew Seman, Jr.**, both of Lexington, all of Ky.

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[73] Assignee: **Lexmark International, Inc.**, Lexington, Ky.

[21] Appl. No.: **09/025,723**

[22] Filed: **Feb. 18, 1998**

*Primary Examiner*—Arthur T. Grimley  
*Assistant Examiner*—George E. Wendal, Jr.  
*Attorney, Agent, or Firm*—John A. Brady

**Related U.S. Application Data**

[60] Provisional application No. 60/051,041, Jun. 27, 1997.

[51] **Int. Cl.<sup>6</sup>** ..... **G03G 15/00**

[52] **U.S. Cl.** ..... **399/167**

[58] **Field of Search** ..... 399/116, 117,  
 399/159, 167

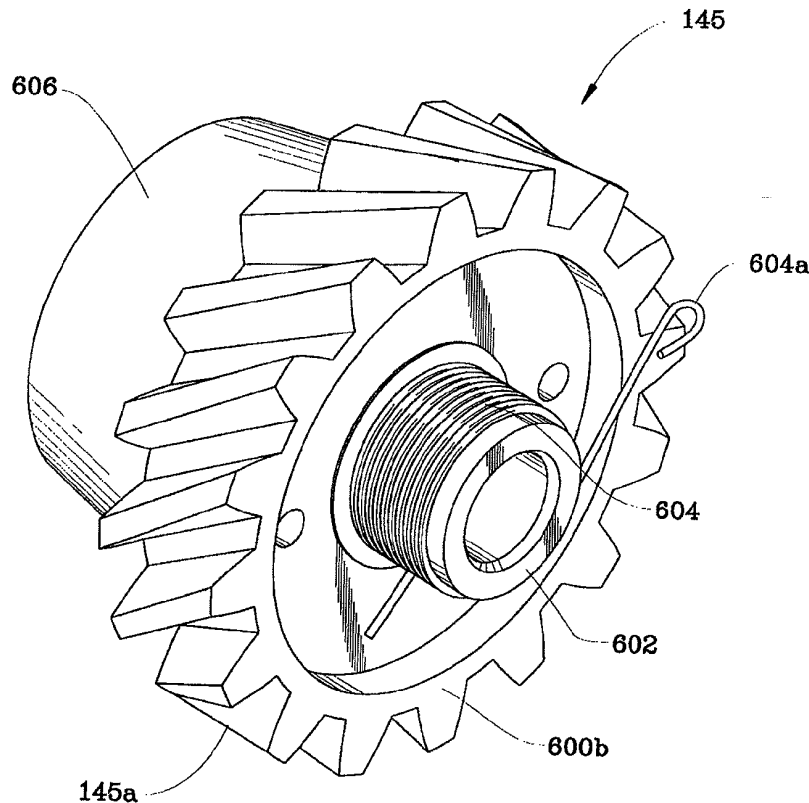
[57] **ABSTRACT**

A toner cartridge (1) contains a photoconductive drum (49) having a central shaft (47). Gear (145) turns with the drum and has a stud (602). A coil spring (604) is mounted on the stud to form a spring clutch which is unwound by the rotation of the drum during imaging. Alternatively, a flat frictional surface is pressed against the side wall (600b) of the gear. Both contact areas have a light grease. The drag forces provide accurate, smooth operation during imaging.

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**7 Claims, 14 Drawing Sheets**



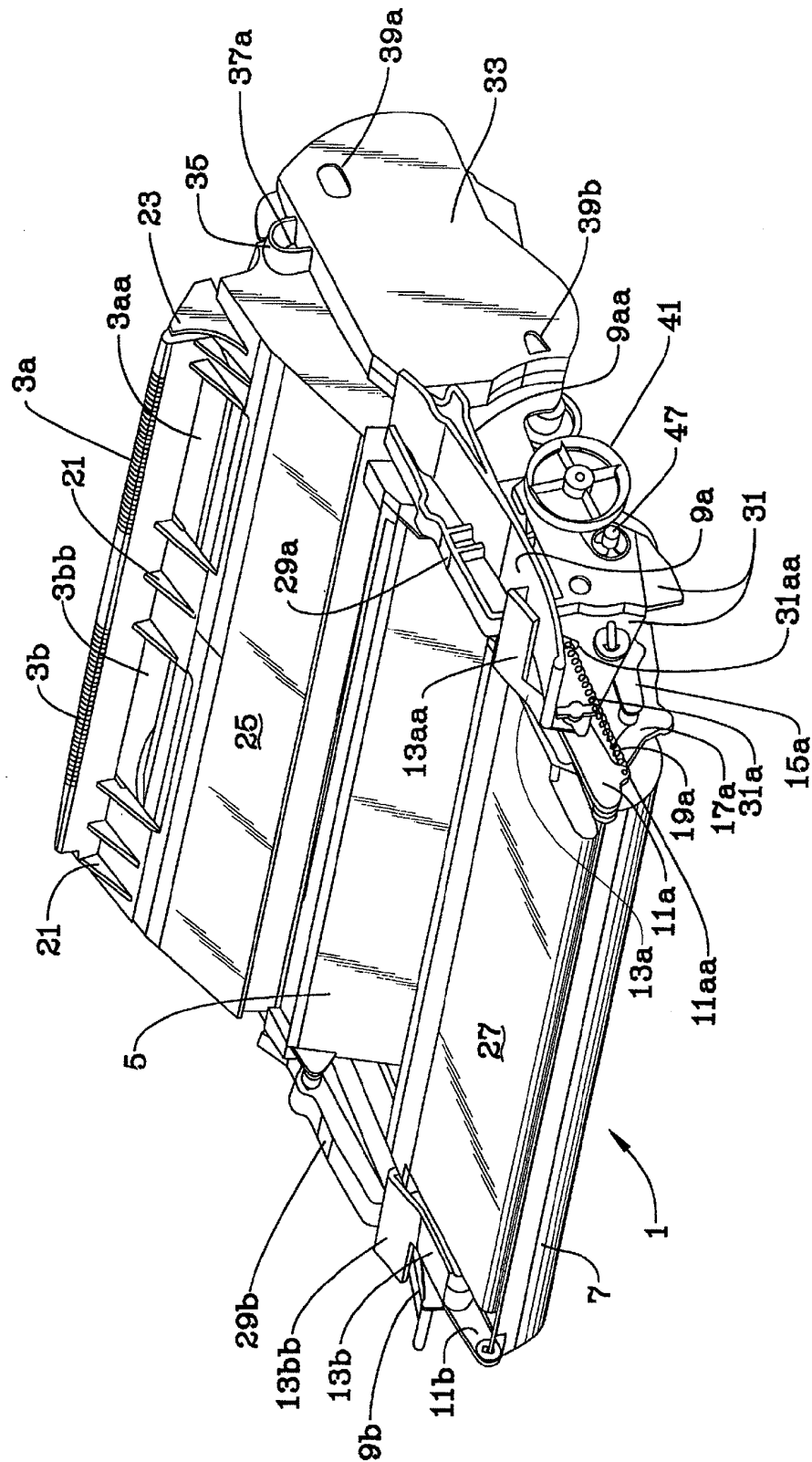
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FIG. 1

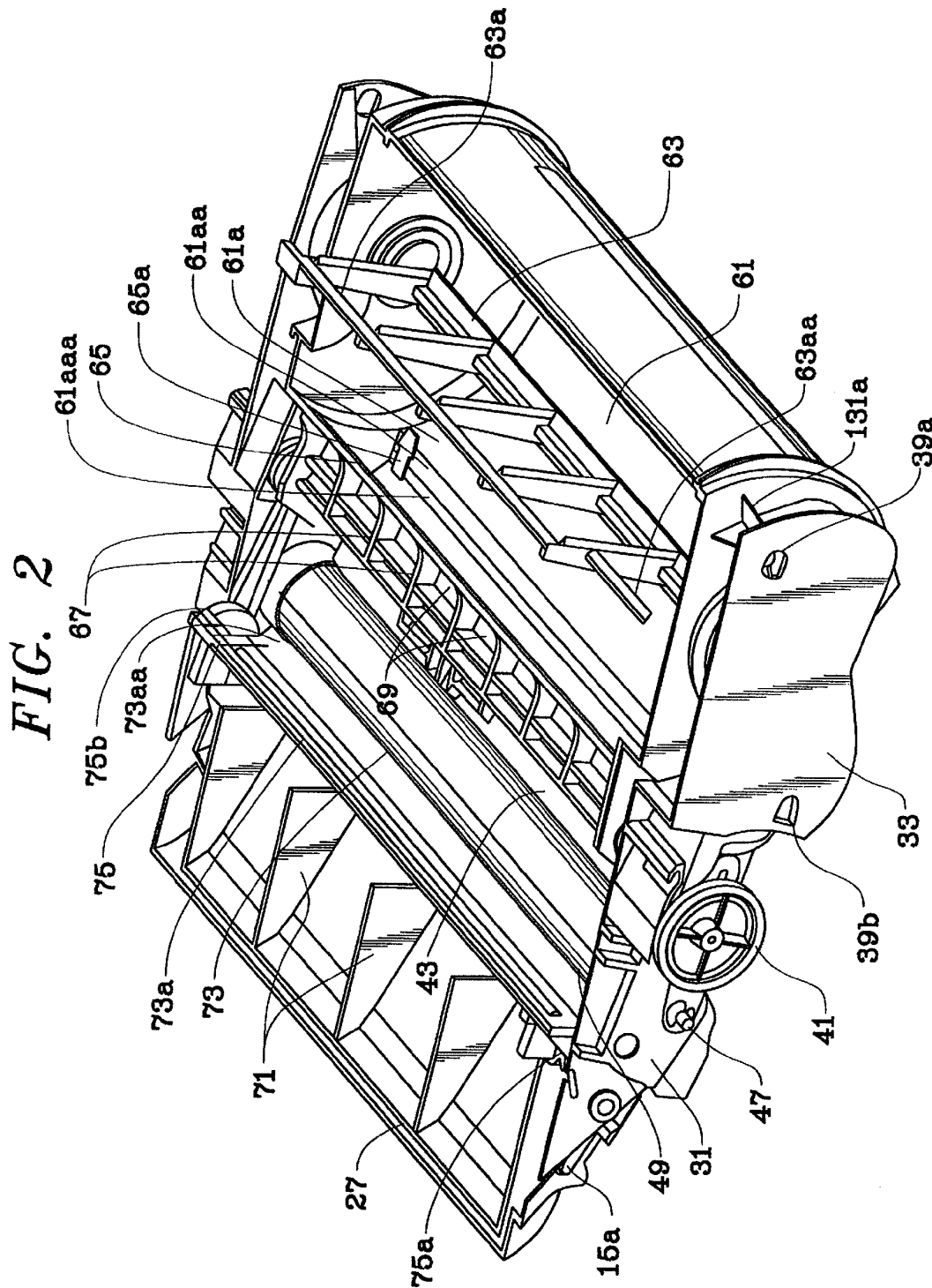


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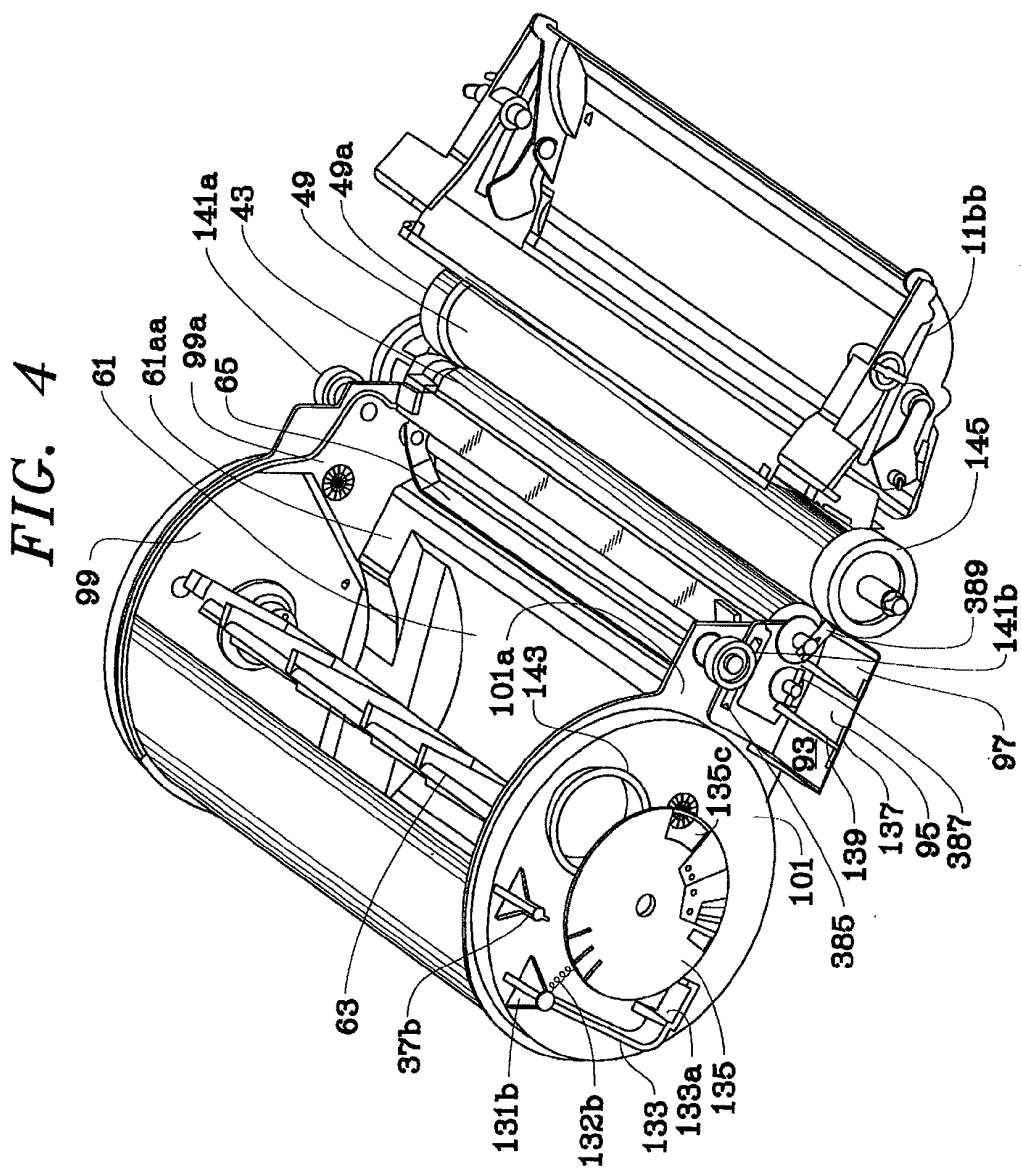


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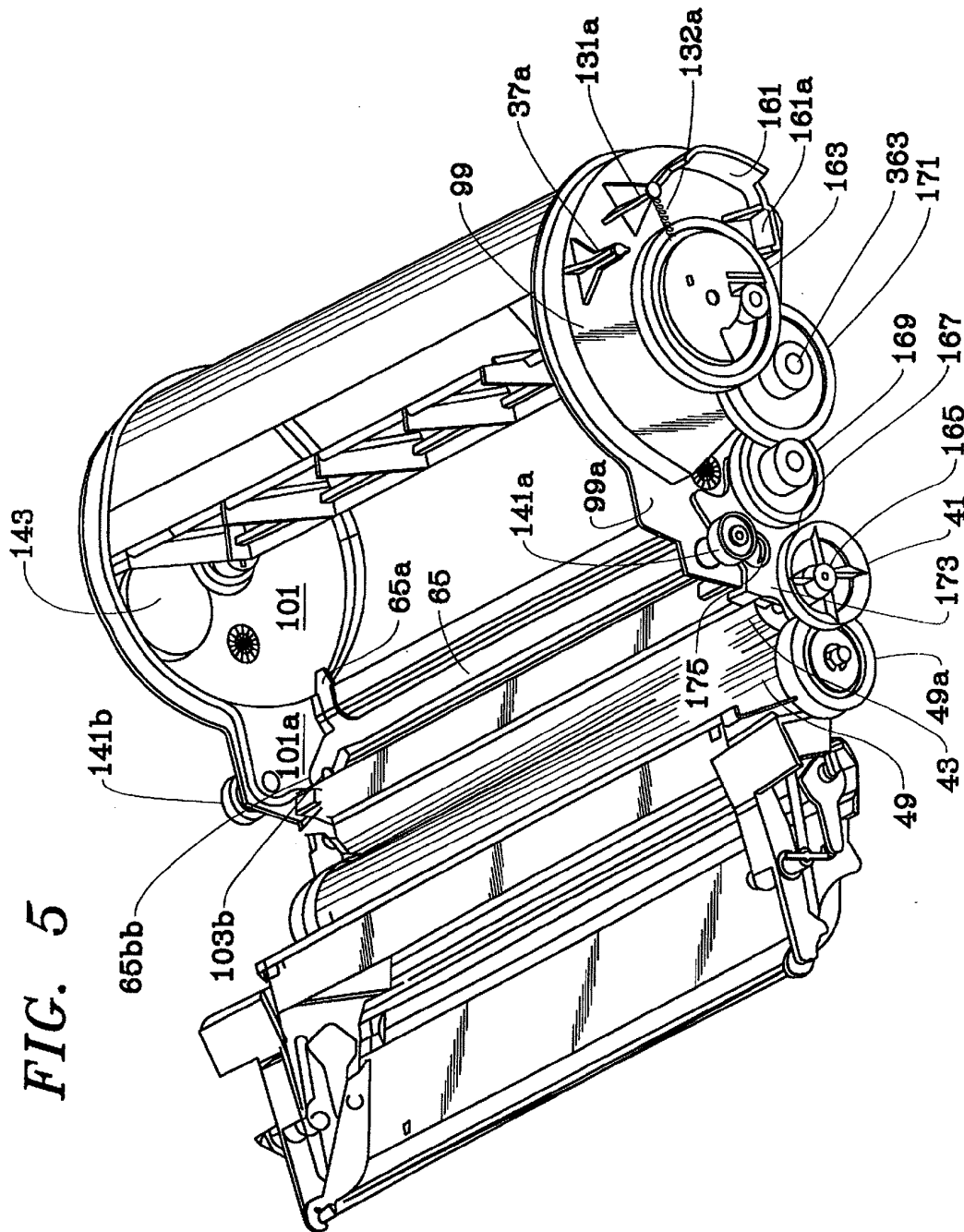
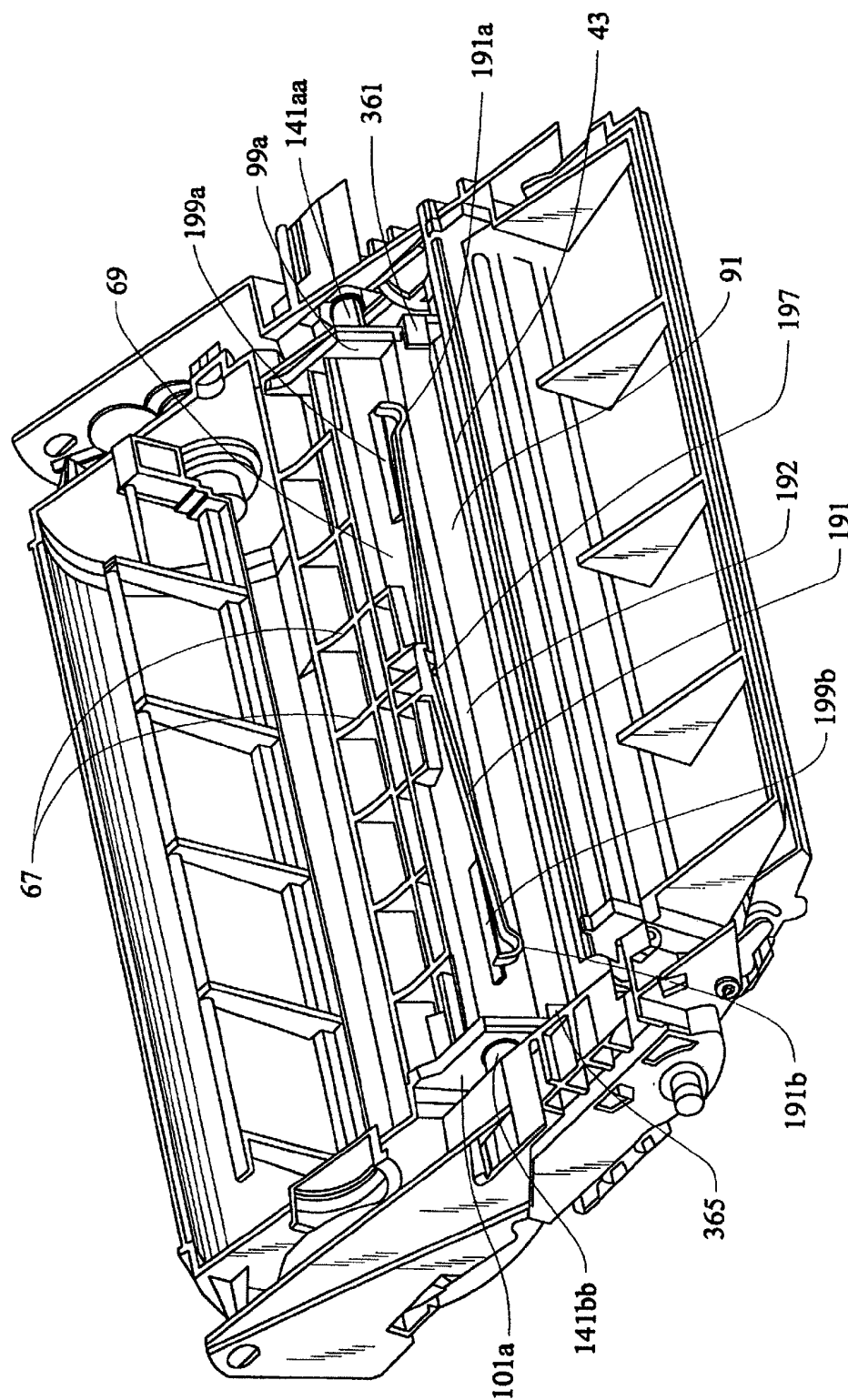


FIG. 6



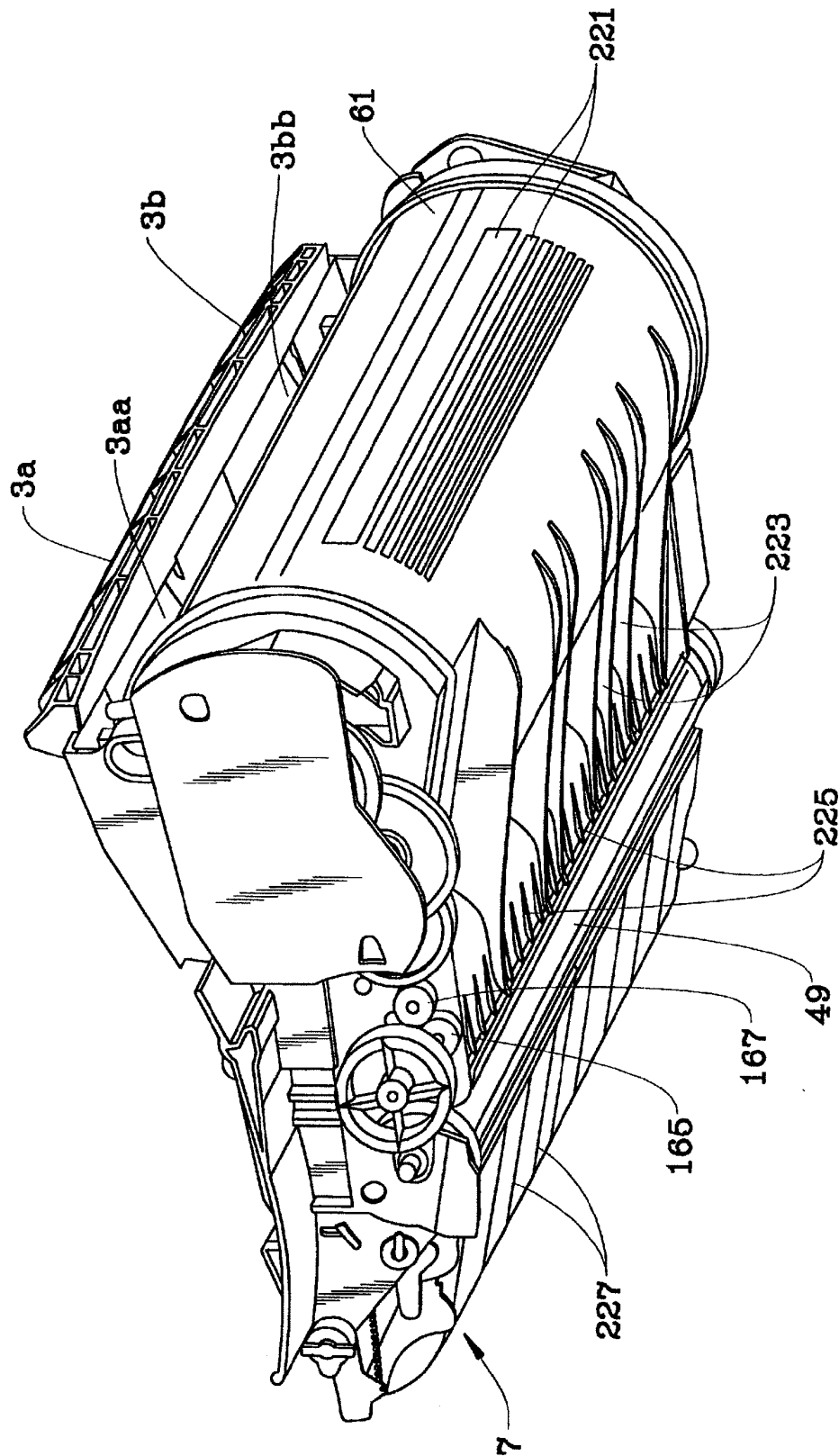
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FIG. 7



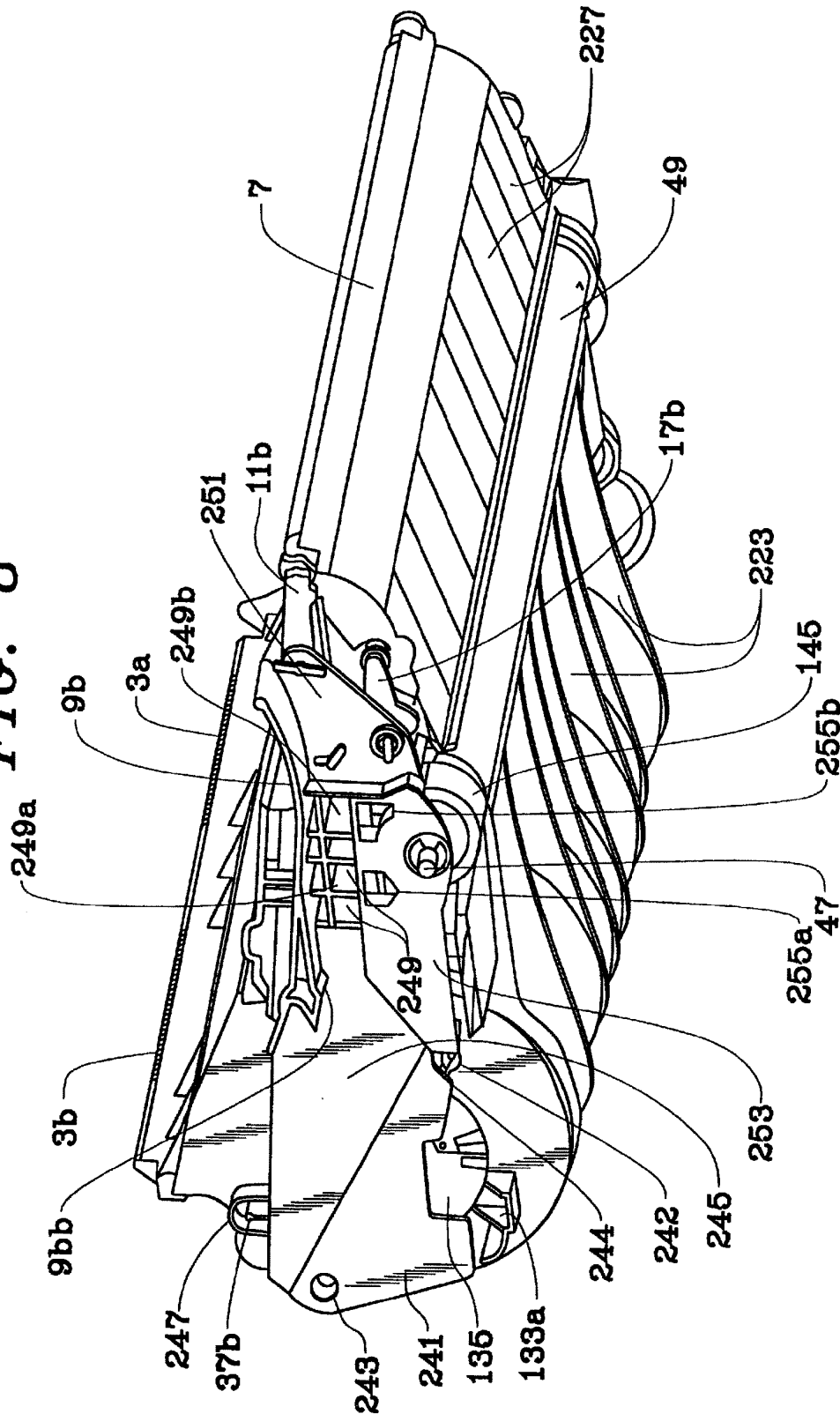
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**FIG. 8**



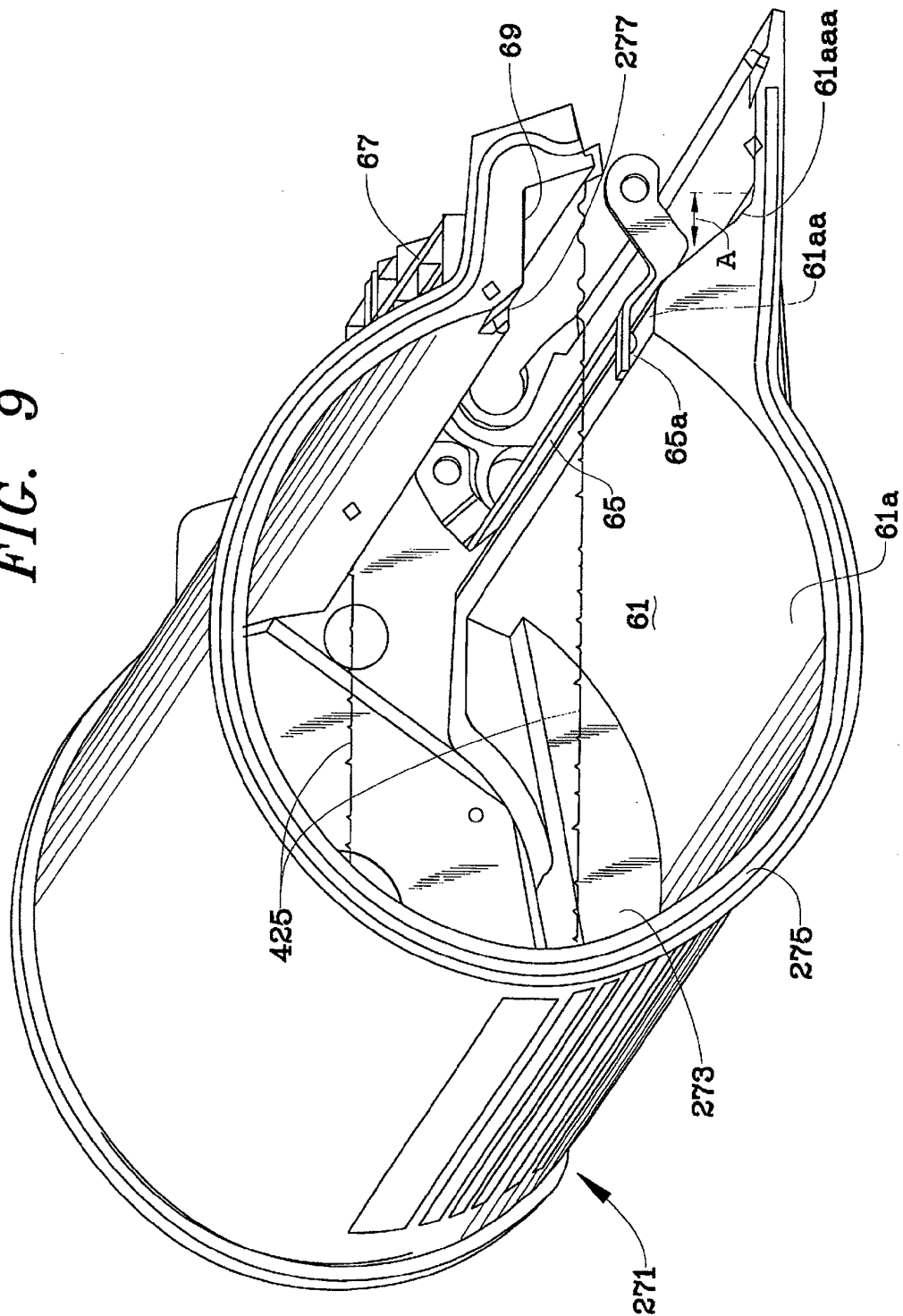
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FIG. 9





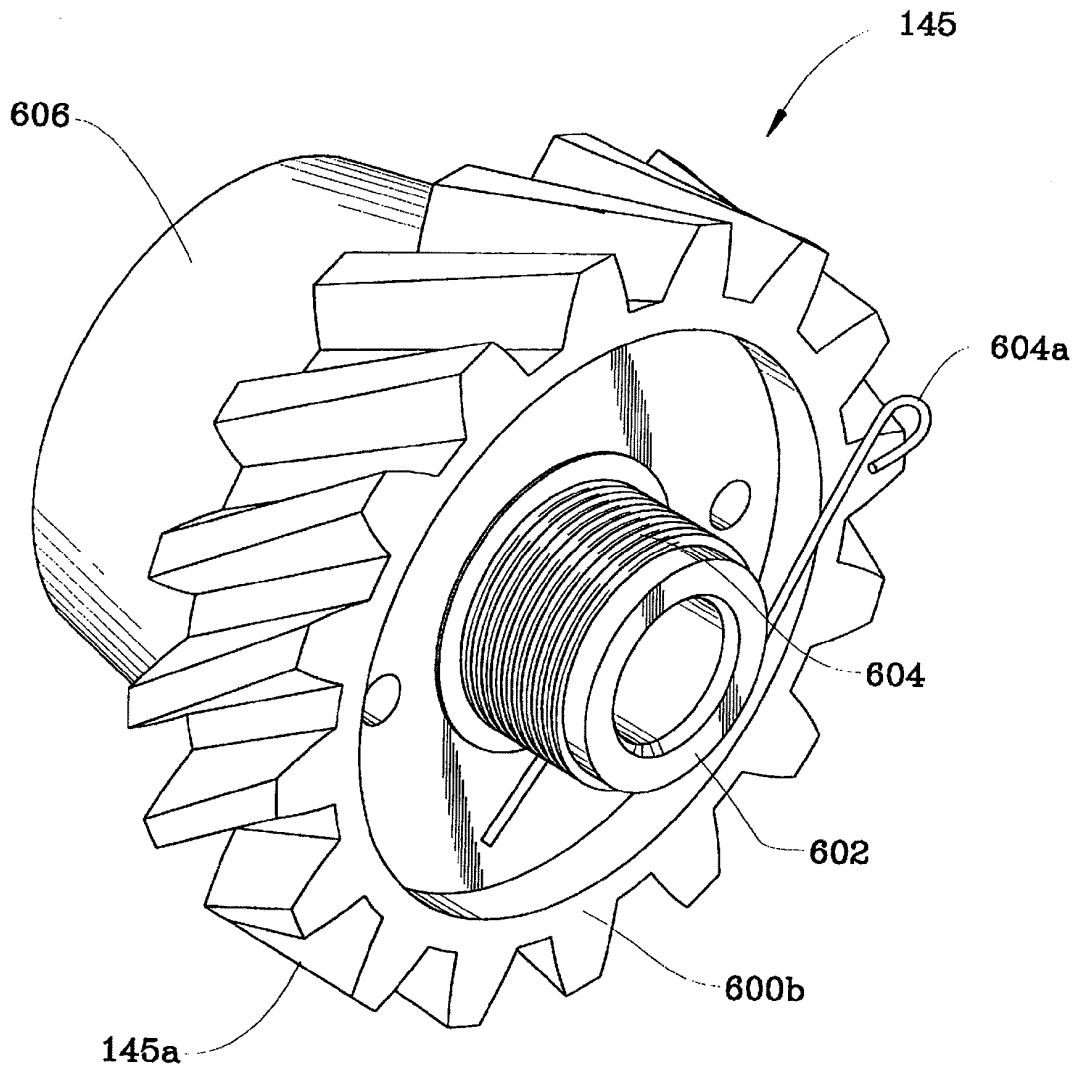
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*FIG. 10*



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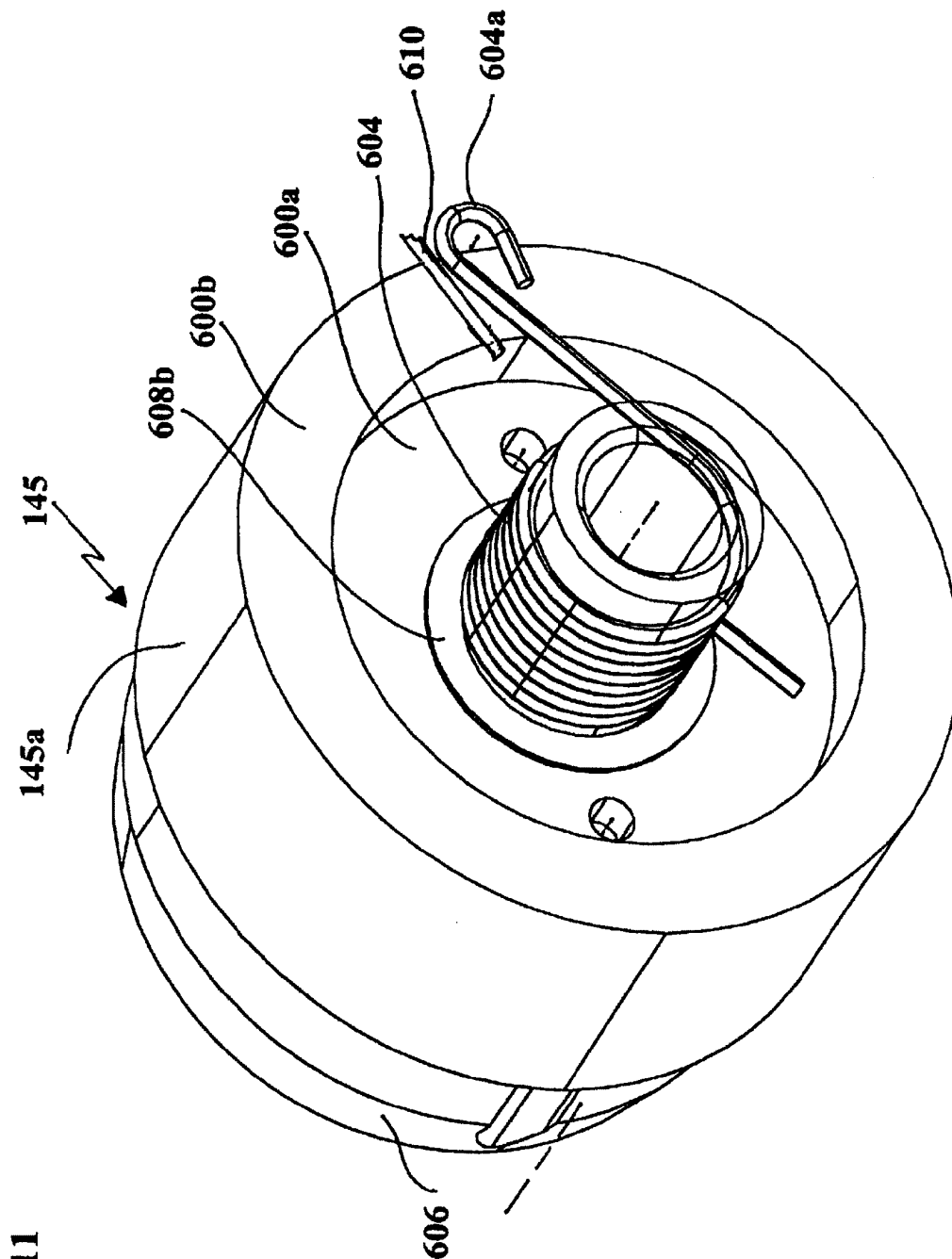


Fig. 11

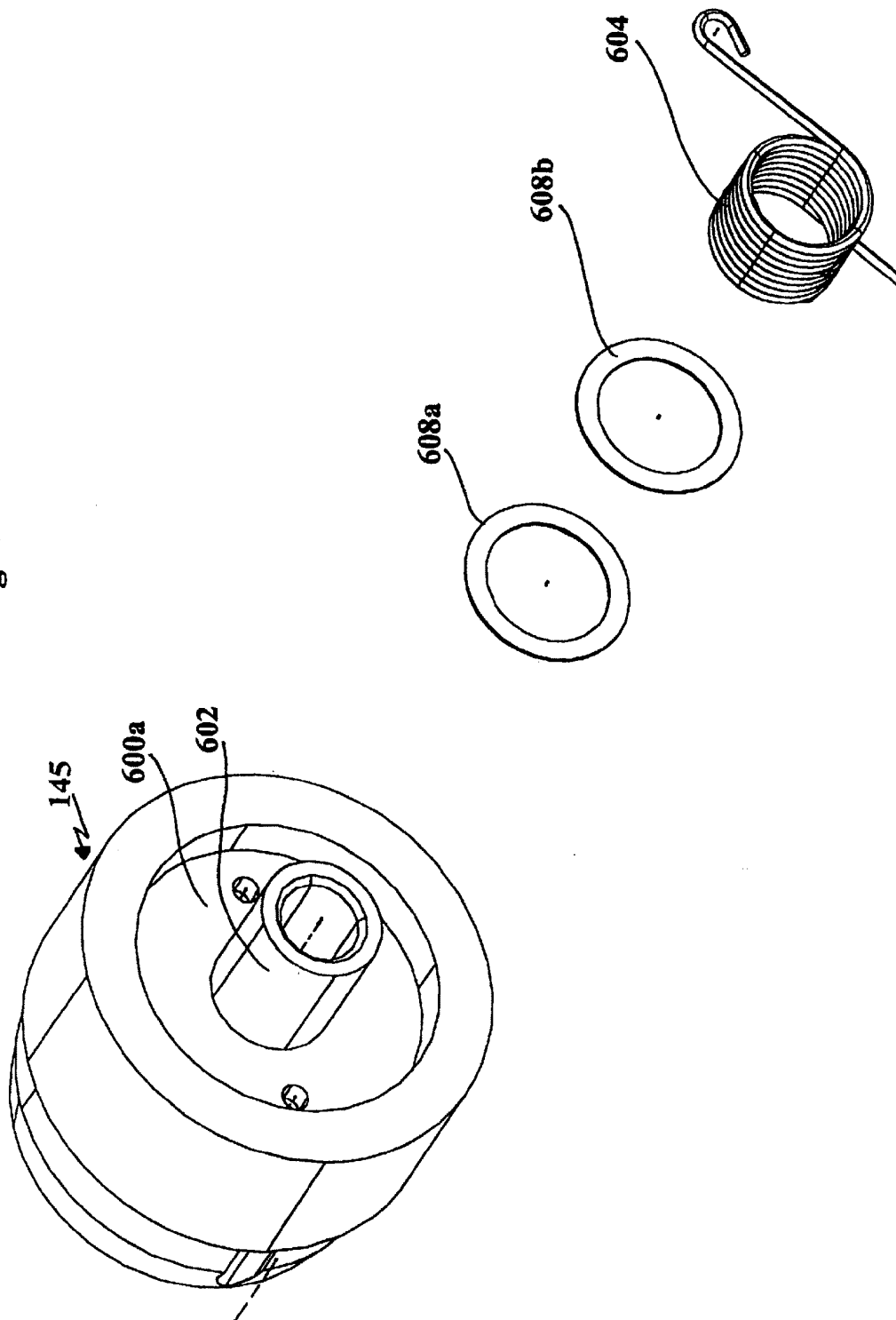
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Fig. 12



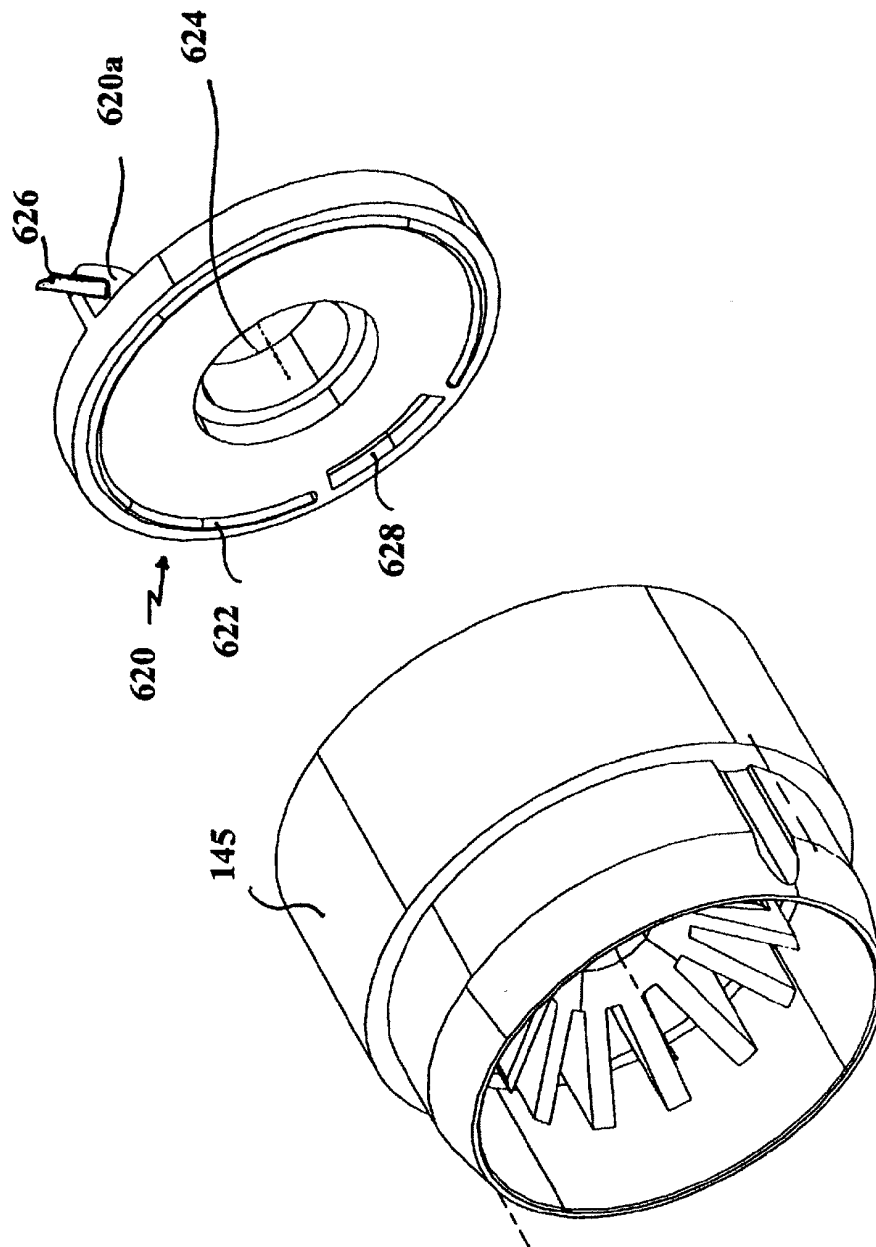
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Fig. 13



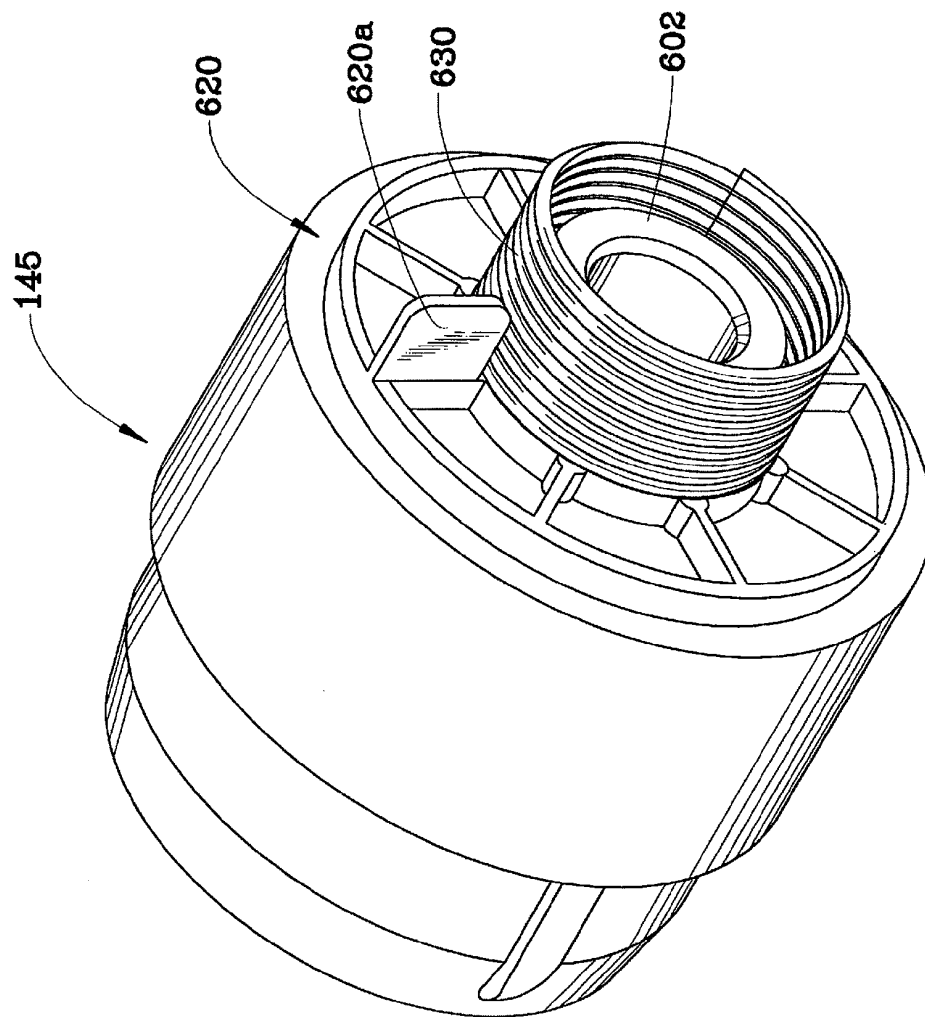
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FIG. 14



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## CONTROL OF PHOTOSENSITIVE ROLLER MOVEMENT

### CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation of Provisional Patent Application Ser. No. 60/051,041 filed Jun. 27, 1997, having the same title as this application.

The preferred embodiment of this invention is incorporated in a toner cartridge described in several United States patent applications filed Dec. 20, 1996, the one more specifically being directed to the photoconductor roller being Ser. No. 08/770,326 entitled "Toner Cartridge with Locating on Photoconductor Shaft," now U.S. Pat. No. 5,758,233.

### TECHNICAL FIELD

This invention relates to electrophotographic development and, more particularly, related to improved control of photosensitive roller movement during imaging operation.

### BACKGROUND OF THE INVENTION

Prior to 1997 the assignee of this invention has manufactured and sold commercially toner cartridges of two different general designs. For its larger laser printers the cartridge has contained a pump to meter toner of the kind disclosed in U.S. Pat. Nos. 5,012,289 to Aldrich et al. and 5,101,237 to Molloy, while the external structure of the cartridge is as disclosed in U.S. Pat. No. 5,136,333 to Craft et al. Details of other elements in the cartridge have varied.

For a smaller, light emitting diode printer, the cartridge is as disclosed in U.S. Pat. No. 5,337,032 to Baker et al., which has a toner hopper extending well below a level having the toner adder roller and which has independent driven systems for the photoconductor roller and for the developer roller system as disclosed in U.S. Pat. No. 5,331,378 to Baker et al.

Cartridges are typically located by elements on their cover or frame, not directly based on the location of photoconductor. In 1997 the assignee of this invention began selling a printer with cartridge having the shaft of the photoconductor drum as the primary locator and a flat ledge opposite for resting on a roller member in the printer. This cartridge contains a photosensitive roller, the central shaft of which extends unobstructed to be contacted by the printer as a vertical and front to rear locator. A hopper and developer roller assembly is attached to the cartridge cover assembly through a spring force. The cartridge cover assembly has elongated surfaces to receive a downward pressing member from the printer. The hopper and developer roller assembly has flat ledges to ride on rollers in the printer thereby permitting adjustment of the contact between the photosensitive roller and the developer roller. A cover assembly integral with the photoconductive roller has a locating surface near the hopper which rests on the frame of the printer positively locating the photoconductive roller.

The two front support wheels which define the plane of lateral movement between the two assemblies are in the printer, with a flat surface on the hopper to receive these rollers. Since the under side of the developer unit is part of the media path, referencing the hopper assembly to the printer improves location accuracy of the media path. The cartridge is resistant to rough handling. A minor advantage is that the cost of the wheels and their installation is eliminated from the cartridge.

The photosensitive roller is integral with a gear with teeth. These teeth mesh with a gear from the printer. Other

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mechanisms in the cartridge are separately driven. However, a photosensitive roller is subject to forces from a paper or other media which are pulled across the roller to transfer the toner image. Another influence is the developer roller, which has a nip contact to the photosensitive roller and a higher tangential velocity.

The photosensitive roller experiences drag from the cleaner blade. However, during use the wear of the cleaner blade results in the drag dropping greatly. Other drag forces, such as at the bearings, are very small.

Paper contacting the photosensitive roller is being pulled by the fixing station while the trailing part of the paper is still in contact with the photosensitive drum. Wrinkle-free paper handling often results in tension from the fuser roller that may be significant.

The effects of low inherent drag on the photosensitive roller, an incidental driving force from the developer roller, and the pull from the fuser roller nip, alone or in combination, can result in imprecise and wavering rotation of the photosensitive roller (termed "jitter"). The teeth between the input gear of the photosensitive roller and the drive gear may actually separate tangentially, resulting in quite apparent distortion of the printed image. Additionally, since pressure at the teeth tends to physically flatten surface defects, loss of such pressure results in some loss of precise rotation and consequent impairment of the printed image.

This invention applies a highly uniform frictional drag to the photosensitive drum. A spring clutch operating in the unwind direction applies such a drag and is so employed. Uniform response is also achieved by having grease at the friction surface. Where drag is produced by lateral movement of two contacting surfaces, the friction characteristics of the grease provide uniform drag. In all cases the grease promotes consistent, smooth operation.

### DISCLOSURE OF THE INVENTION

To obtain high precision control of the photosensitive roller from the drive gear intended to control the roller, a frictional member having uniform drag is pressed against the photosensitive roller with the area of contact having a grease. Preferably, the frictional member is a coil spring clutch tightly wrapped around a stud which surrounds the roller shaft, with roller operation being in the direction to unwind the spring. On the side of the spring facing the side wall of the roller, two low friction washers separate the spring from the side wall so that the one contacting the side wall normally turns and the one contacting the spring remains stationary, thereby protecting the end of the spring from rubbing contact.

The term "spring clutch" is used to designate a mechanism in which one end of the spring is prevented from rotating, thereby, as is conventional, permitting the spring to wind tight or unwind depending on the rotation of the shaft on which the spring is wound.

An alternative frictional member is a flat surface pushed into contact with the side wall of the photosensitive roller.

The term "photosensitive roller assembly" is used to incorporate necessary elements to this invention connected to the roller, such as the stud and side wall.

### BRIEF DESCRIPTION OF THE DRAWINGS

The details of this invention will be described in connection with the accompanying drawing, in which FIG. 1 is a perspective view of the toner cartridge from above and left rear, where left is determined facing the printer from its front



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side where cartridge insertion is made; FIG. 2 is a perspective view from above and left front of the cartridge sectioned near the top; FIG. 3 is a top right front view of the cartridge with further cover elements removed; FIG. 4 is a top right rear view of the cartridge with cover elements removed; FIG. 5 is a top left rear view of the cartridge with cover elements removed; FIG. 6 is a top right rear view of the cartridge sectioned similarly to the sectioning of FIG. 2; FIG. 7 is a bottom left front view of the cartridge; FIG. 8 is a bottom right rear view of the cartridge; FIG. 9 is a front right perspective view of the hopper housing member; FIG. 10 is a reproduction of a photograph of a perspective view of the installed coil spring; FIG. 11 is a line drawing of a perspective view similar to FIG. 10; FIG. 12 is an exploded view otherwise similar to FIG. 11; FIG. 13 is an exploded perspective view of a frictional element having a flat surface; and FIG. 14 illustrates the element of FIG. 13 assembled.

### BEST MODE FOR CARRYING OUT THE INVENTION

The self-contained, removable printer cartridge 1 is shown in FIG. 1 in a perspective view from above and left rear (the hand grips 3a and 3b being considered the front and the side having the pivoted upper shutter 5 being the upper side).

For purposes of illustration, FIG. 1 shows the upper shutter 5 pivoted downward to its open position and lower shutter 7 pivoted rearward and upward to its open position. In actual operation, these positions are reached by interaction with the printer or other device in which cartridge 1 is installed as will be explained below.

To facilitate and guide insertion of cartridge 1 into the printer, cartridge 1 has a left guide wing 9a and a right guide wing 9b. Guide wings 9a and 9b are thin planes formed as arcs of a relatively large circle, except near the front, where the bottom 9aa is enlarged downward. Guide wings 9a and 9b are mirror images of each other except that, in this particular embodiment described, the left guide wing 9a is wider (extends further laterally) than the right guide wing 9b simply to accommodate the width provided by a particular printer in which the exemplar cartridge 1 is to be installed.

In the embodiment herein described, bottom shutter 7 is pivoted from left-rear cover 31a on a left top actuator link arm 11a and from rear cover (not shown) on a right top actuator link arm 11b, located on opposite sides of shutter 7. Each link arm 11a, and 11b is integral with an actuator 13a, and 13b, respectively, each of which has a rectangular actuator surface 13aa and 13bb, respectively, which extends over the respective guide wings 9a, 9b.

A pivoted lower shutter link 15a and a side of the lower shutter 17a, pivoted to lower shutter link 15a and left top actuator link arm 11a complete a conventional four bar linkage to provide rotation of shutter 7 in response to rotation of actuator 13a. The rear end of coil spring 19a connects to a lower hook 11aa in link arm 11a to bias is shutter 7 closed when the cartridge is not inserted in a printer or other device. The front end of coil spring 19a connects to an upper hole 31aa under actuator 13a. A mirror image of these parts (see FIG. 3) exists on the opposite side, the corresponding part of which will be designated by the same number with "b" letters.

When cartridge 1 is installed in the printer, actuator surfaces 13aa and 13bb are pushed downward by the mating surfaces of the printer to the positions above wings 9a, 9b respectively, as shown in FIG. 1.

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Cartridge 1 is inserted by a human operator grasping grips 3a, 3b through holes 3aa, 3bb and moving cartridge 1 in the direction of shutter 5 and toward the rear of the printer in which it is being installed. A series of upwardly extending ribs 21 spaced along the width of cartridge 1 under grips 3a, 3b, except at holes 3aa and 3bb, provide strength while holes 3aa and 3bb provide room for the fingers of a person to grasp grips 3a, 3b. On the left side is a relatively wide, upwardly extending tab 23. In a preferred combination of the embodiment of the invention described herein and an exemplary printer the top of tab 23 interacts with a physical sensing switch in the printer to detect that a cartridge 1 has been installed.

Front cover 25, on which grips 3a, 3b, ribs 21 and tab 23 are integrally formed, is above a separated toner hopper, as will be described. The top cover of cleaner chamber 27 is rearward of shutter 5.

Immediately inside wings 9a and 9b are raised, elongated locator surfaces 29a, 29b to which pressure is applied by a printer to firmly position the toning mechanisms of cartridge 1 when cartridge 1 is installed. Locator surfaces 29a and 29b, wings 9a and 9b, as well as rear cover 31 under wing 9a, are formed integral with cleaner housing 27. Also integral with these elements is front cover 25, having grips 3a, 3b and an outer cover 33 on the left side and generally coextensive in length with the length of front cover 25. Cover 33 has a U-shaped housing 35 at its top. Housing 35 traps spacer stud 37a as will be explained and an assembly hole 39a near the upper front of cover 33 and a spring-holding hole 39b near the lower front of cover 33.

A coupler 41 receives a drive element from a printer which contains an Oldham coupler to rotatably drive the developer roller 43 (not shown in FIG. 1) and toner adder roller 45 (not shown in FIG. 1). To the rear of coupler 41 is the shaft 47 of photoconductor drum 49 (drum not shown in FIG. 1).

FIG. 2 is a perspective view from above and left front of cartridge 1 sectioned near the top to show internal elements. At the immediate front is a large, cylindrical toner hopper 61, having a paddle 63, which, during operation, is rotated clockwise as seen in FIG. 2. Paddle 63 has an outer toner moving bar 63a, which extends across the width of hopper 61 except for a far left section 63aa which is inset as will be explained. The rear wall 61a of hopper 61 when cartridge 1 is installed for operation in a printer terminates at about one-third of the total height of hopper 61 as a flat surface 61aa (specifically, hopper 61 has a 106 mm diameter and the distance vertically from the lowest point of hopper 61 to the horizontal plane coinciding with the highest point surface 61aa of rear wall 61a is 35.3 mm). The upper surface 61aa of rear wall 61a is thin and flat with a slight downward angle from hopper 61 to facilitate removal of the molded part from its mold. An extension 65a from an agitator bar 65 has a depending tab 65b (see FIG. 9) which rests on upper wall 61aa thereby positioning agitator bar 65 slightly above upper wall 61aa. Extension 65a extends past upper wall 61aa to a location at which bar 63a of paddle 63 encounters extension 65a as it rotates. The surface 61aaa opposite surface 61aa from which toner exits is flat and at approximately 50 degrees from vertical ("A" in FIG. 9) when cartridge 1 is installed for operation in a printer.

Vertical ribs 67 located immediately rearward of rear wall 61a are stiffeners for top wall 69 formed about one-third down from the top of hopper 61. The toner moving bar 63a of paddle 63 is closely adjacent to the sides of hopper 61 except where the top of rear wall 61a and the start of top wall

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69 form an opening for toner to be delivered rearward from hopper 61 to the toning mechanisms of cartridge 1. This is best shown in FIG. 9.

In FIG. 2, a small part of developer roller 43 to which coupler 41 is directly attached, is seen past ribs 67. Developer roller 43 is parallel to and in contact with photoconductor drum 49. Cleaner chamber 27 has spaced, vertical internal baffles 71, which are strengthening members, as well as members which limit unbalanced accumulation of toner in chamber 27. Toner which is not transferred during development is scraped from photoconductor drum 49 by cleaning blade 73, which is mounted to a vertical panel 73a, having a horizontal gusset 73aa to increase strength. As best seen in FIG. 3, panel 73a is mounted to supporting member 75, which has vertical columns 75a (FIG. 2), 75b on opposite sides. Panel 73a is mounted to the vertical columns 75a, 75b by a screw 77a to column 75a and a screw 77b to column 75b.

FIG. 3 is a top right side view with further cover elements removed and part of the cleaner removed to illustrate the internal configuration of cartridge 1. A solid, steel-bar doctor blade 91 extends parallel with and in pressure contact with developer roller 43. Blade 91 contacts roller 43 at about 20 degrees from the vertical toward toner adder roller 45. Also shown in FIG. 3 are metal electrical contact 93 to doctor blade 91, metal electrical contact 95 to toner adder roller 45 and metal electrical contact 97 to developer roller 43. The outer ends 93a, 95a, 97a of the contacts bear against metal contacts in the printer when cartridge 1 is installed and thereby make electrical contact to receive electrical potentials from the printer.

The developing system of cartridge 1 is essentially very similar to that of the OPTRA family of printers sold by the assignee of this invention. As in that family of printers, toner adder roller 45 is a conductive sponge material attached to a steel shaft and developer roller 43 is semiconductive material attached to a steel shaft. When cartridge 1 is installed for operation in a printer, cartridge 1 is oriented generally as shown in FIG. 3 and the horizontal plane containing the lowest surface of toner adder roller 45 is 22.6 mm above the lowest point of hopper 61.

Toner adder roller 45 and developer roller 43 are journaled in the rearward extensions 99a and 11a (FIG. 4) of the end members 99 and 101 (FIG. 4) of hopper 61. Agitator 65 has a bent portion 65aa to become parallel to extension 99a where it is pivoted to extension 99a on pin 103a. As paddle 63 rotates, bar 63a contacts extension 65a, thereby rotating agitator 65 around pin 103a upward. Agitator 65 then returns to near rear wall 61a under the force of gravity to dislodge toner, which otherwise tends to accumulate on exit surface 61aaa (see FIG. 9). Since this application is directed to improved control of movement of photoconductor drum 49, further details of toner movement will be minimized in this description.

FIG. 4 is a top right rear view with cover elements removed showing more fully the end members 99 and 101 of hopper 61 and their extensions 99a and 101a. Integral with end member 101 is spacer stud 37b. Under and to the front of stud 37b is spring mounting post 131b, which mounts one end of spring 132b, the other end of which (not shown) is mounted on hole 242 (see FIG. 8) of the cover.

Also integral with end member 101 is perpendicular shield wall 133, which extends downward and rearward to present a barrier to physically protect encoder wheel 135. Further details of the encoder wheel are not pertinent to this invention.

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FIG. 4 also shows electrical contacts 93, 95 and 97 as they are supported by floor 137 which extends perpendicularly from hopper extension 101a. Vertical ribs 139 extend from floor 137 between contacts 93, 95 and 97 to strengthen the floor 137.

Mounting roller 141a is journaled to hopper extension 99a and symmetrical mounting roller 141b is mounted to hopper extension 101a. Rollers 141a and 141b contact inside surfaces of the cover of cartridge 1, as will be described. Surfaces 133a and 161a (FIG. 5) of hopper 61 rest on rollers (not shown) in the printer as will be further described.

Hopper end member 101 has an opening receiving a closely-fitting, resilient, cylindrical plug 143. Prior to installing plug 143, toner is loaded into hopper 61 through the open hole, then plug 143 seals the hole.

Photoconductor roller 49 has at its left end a gear 49a fixed to roller 49. At its right end photoconductor roller 49 has a transfer roller drive gear 145, which drives a roller in the printer when cartridge 1 is installed in the printer. Gear 49a is a helical gear with teeth (not shown in FIG. 4) which mesh with teeth of a gear (not shown) in the printer to receive drive torque to rotate photoconductor roller 49 during imaging operation.

Gear 145 is a molded integral plastic element having an inner side wall 600a and outer side wall ridge 600b and a central stud 602 (FIG. 10) through which shaft 47 extends. In accordance with this invention, a coil spring 604 (see FIG. 10) forms a spring clutch.

FIG. 5 is a top left rear view with cover elements removed showing more fully the outside of members 99 and 99a of hopper 61. Integral with end member 99 is spacer stud 37a. Under and to the front of stud 37a is spring mounting post 131a, which mounts one end of spring 132a, the other end of which is mounted in a hole (not shown) in a member, which is an inner extension of cover 33 (FIG. 2).

Also integral with end member 99 is perpendicular shield wall 161, which extends downward and rearward to a barrier to physically protect torsional paddle gear assembly 163. The bottom portion of wall 161 forms a flat contact surface 161a to receive a locating roller from the printer when cartridge 1 is installed. The details of paddle gear assembly 163 are not relevant to the present invention.

Gear 49a, integral with the end of photoconductor drum 49, receives power from a meshing gear (not shown) in the printer when cartridge 1 is installed in the printer. Coupler 41 is integral with developer roller 43 and drives idler gear 165, which drives toner adder roller 45 (FIG. 3) by being meshed with gear 167, which is integral with toner adder roller 45. Coupler 41 receives power from a driver (not shown) in the printer which is separate from the drive (not shown) to drum 49, although preferably from a single motor in the printer.

Gear 167 drives the large gear of compound gear 169. Gear 169 drives the large gear of compound gear 171, and gear 171 drives paddle gear assembly 163. A gear plate 173, mounting gears 165 and 169, is mounted on hopper extension 99a by mounting screw 175.

FIG. 5 shows the end of agitator 65 opposite that shown in FIG. 3. That end has a bent portion 65bb to become parallel to extension 101a of end member 101 when it is pivoted to extension 101a on a pin 103b.

Continuing the detailed description of the cartridge incorporating a preferred embodiment of the present invention, FIG. 6 is a top right rear view sectioned near the top similar

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to the sectioning of FIG. 2. FIG. 6 illustrates more clearly the mounting of doctor blade 91 mounted to press on developer roller 43 under the bias of leaf spring 191. Blade 91 is located on the left rear by tab 361 and on the rear by extension of hopper end member 99 which forms front and back barriers for holding the left side of doctor blade 91. Similarly, on the right side, two surfaces extending from extension 101a, including a rear extension 365 and a front extension 366 (not shown) form front and back holding the right side of doctor blade 91, symmetric to the cage holding the left side of doctor blade 91. The top of blade 91 is held by spring 191. An adhesive tape 192 across the top of the doctor blade 91 bridges over the adjoining horizontal edge of wall 69 (FIG. 2) for sealing, as is conventional.

Spring 191 has blunt ends 191a and 191b, spaced from the center, which contact blade 91 to bias it downward on to developer roller 43. A central ledge 197, integral with ribs 67, forms a cavity receiving the center of spring 191. Horizontal ledges 199a and 199b, opposite central parts of spring 191, formed integral with ribs 67, are horizontal barriers to prevent spring 191 from moving toward the front. Preferably, so as to permit rough handling of cartridge 1 which might occur during shipment, solid upper stop members (not shown) are attached by double sided adhesive on each side between ledges 199a and 199b and the sides 99a and 101a, respectively. These are spaced 0.18 mm above the top of blade 91 and, therefore, contact blade 91 only during rough handling.

FIG. 6 also illustrates posts 141aa and 141bb, which are molded as extensions of members 99a and 131a, respectively, and supporting mounting rollers 141a and 141b, respectively (FIG. 5).

FIG. 7 is a bottom left front depiction of cartridge 1 viewed externally. A series of horizontal depressions 221 along the back of hopper 61 provide a roughened surface for thumbs when fingers grasp the cartridge through opening 3aa and 3bb. A series of relatively long vertical ribs 223 integral with the bottom of hopper 61 serve as paper and other media guides, while a series of shorter ribs 225, located rearward of the start of ribs 223 and between ribs 223, prevent media snags as media encounter photoconductor drum 49, located immediately after ribs 223 and 225. Past drum 49, media encounter further media guide ribs 227 located on the bottom of shutter 7. FIG. 7 also affords a clear view of idler gear 165 and gear 167.

FIG. 8 is a bottom right rear depiction of cartridge 1 viewed externally. This shows the full right guide wing 9b with enlarged front part 9bb. FIG. 8 shows the right cover elements which were deleted in FIG. 6. A front lower cover section 241 is over much of the encoder wheel 135 and has an access hole 243 for ease of assembly and has an access opening 244. Cover section 241 is stepped outward a small amount to provide room for spring (not shown) to extend between post 131b (FIG. 4) and hole 242. Generally, above and forward of and integral with cover section 241 is cover section 245, which is over the remaining upper front of cartridge 1. Section 245 has a U-shaped housing 247 at its top which traps spacer stud 37b. In the rearward part of section 245 opposite the area above photoconductor drum 49, are located rectangular channels 249 with the second rectangular channel 249a and the last rectangular channel 249b being open to pass air for cooling photoconductor drum 49 during operation of cartridge 1.

The far rear portion 251 of this particular embodiment of the invention herein described mounts links 11b and 17b to shutter 7. A bottom section 253 of the cover located under

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and forward of passages 249a and 249b mounts the shaft 47 of photoconductor drum 49 and has two upper symmetrical vent holes 255a and 255b to pass air for cooling drum 49.

FIG. 9 is a front right perspective view of the molded plastic member housing 271 which forms the central portion and central extension of hopper 61 with end member 99 attached and agitator 65 installed. It is seen to form a cylindrical chamber with an exit opening formed between wall 69 and wall 61a. An inset 273 at the bottom rear of hopper 61 provides space for rollers in the printer. As best seen in FIG. 2, paddle bar 63a has an inset 63aa to clear inset 273.

Member 271 has a slot 275 around its right side. A directly similar slot is around the left side. End member 101 has a mating ridge 321 (not shown). During manufacture slot 275 is mated with that ridge in end member 101 and the two are welded together with ultrasonically created heat. Member 99 is welded to the left side of member 271 in the same manner with ridge (not shown) inserted in a mating slot (not shown) on the left side of member 271.

A notch 277 above agitator extension 65a allows for sufficient rotation of agitator 65 to allow paddle arm 63a (as best seen in FIG. 2) to pass beyond extension 65a while preventing a full turn-over of agitator 65.

#### Developer Assembly

The housing 271 and its attached end members 99 and 101, form toner hopper 61. As best seen in FIG. 5, extension 101a journals toner adder roller 45 and developer roller 43. Gear plate 173, which is attached to extension 99a by screw 175, journals the opposite ends of toner adder roller 45 and developer roller 43. Accordingly, a single unitary assembly is formed of the hopper 61 rearward to and including developer roller 43.

#### Photoconductor and Cover Assembly

Front cover 25 grips 3a, 3b, left outer cover 33, rear wall 31, (FIG. 1) right cover sections 241, 245, and 251, (FIG. 8) wings 9a, 9b and cleaning chamber 27 are a single molded part. Photoconductor 49 is journaled in this part with its shaft 47 extending past the covers on opposite sides. Shutter 7 is movably supported to left cover 31 and right rear cover 251. Accordingly, a single unitary assembly is formed of the cover members, the photoconductor drum 49 and the shutter 7.

In use, springs 132a (connected as described at the left side of cartridge 1 at an extension of cover 33) and 132b pull the developer roller 43 against the photoconductor drum 49 at a predetermined tension. When cartridge 1 is picked up, the developer assembly and the photoconductor and cover assembly rotate under gravity until stud 37a (FIG. 1) contacts housing 35 and stud 37b (FIG. 8) contacts housing 247, thereby holding the two assemblies together.

#### Toner

In a preferred embodiment cartridge 1 employs mono-component electrophotographic toner which may be basically conventional. The amount of toner in hopper 61 is limited by pressure impairing print quality and sensing of toner level by toner resistance on paddle 63. When cartridge 1 is in the installed position, a typical top level of toner will be somewhat above the upper barrier wall 61aa. The presence of toner at a highest level is indicated in FIG. 9 by surface lines of toner 425, but the toner is shown otherwise as transparent for clarity. The actual toner is, of course, an



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opaque, dry powder. During use, the toner is depleted to lower levels and it is moved by paddle 63. As is conventional, developer roller 43 applies toner 425 to photoconductor drum 49 to develop electrostatic images on photoconductor drum 49.

#### Drag Elements

FIG. 10 shows details in the nature of a photograph of the gear 145 having coil spring 604 wrapped on stud 602. The tapered portion 606 opposite stud 602 enters photoconductor drum 49 to make a press fit within. Accordingly, in operation 145 is fixed to drum 49 and turns with it to form an assembly with drum 49. Outer side wall ridge 600b is seen in FIG. 10, and the teeth 145a are seen as helical gear teeth. Spring 604 has outer tang 604a, which is blocked from moving during normal operation so that a spring clutch is formed, (i.e., spring 604 is loosened by the blocking of tang 604a unwinding 604). Tang 604a is not blocked on the opposite side as any backward motion of gear 145 with tang 604a blocked would strongly tighten spring 604 on stud 602.

FIG. 11 is a larger line drawing similar to FIG. 10, but showing the teeth 145a only by their outside diameter. FIG. 11 shows the inner side wall 600a and the outer washer 608b. FIG. 11 also shows illustratively a ridge 610 in cover 253 which blocks tang 604a as shown during normal rotation of drum 49 during imaging.

As best seen in the exploded view of FIG. 12, two washers 608a and 608b made of fluorocarbon and, therefore, of low friction are on stud 602 and separate the side of spring 604 from the side wall 600a of gear 145. When spring 604 moves or is mechanically biased toward side wall 600a, washer 608a contacts side wall 600a and washer 608b contacts spring 604. As the friction between washers 608a and 608b is lower than the friction between washer 608a and side wall 600a, and is lower than the friction between washer 608b and spring 604, washer 608b is stationary during rotation of drum 49 while washer 608a rotates. This assures that the end of spring 604 does not contact a moving surface with enough frictional force to cause a disturbance, thereby assuring smooth operation of spring 604.

FIG. 13 illustrates an element 620 having a raised circular outer ridge 622 that has a flat planar surface to contact outer side wall 600b. Element 620 has a central hole 624 which fits over stud 602 of gear 145. Element 620 has an extending knob 620a which is blocked by a frame element, illustratively indicated by a ridge 626 in the cover 253. Hole 628 is to insert grease between ridge 622 and gear 145. A coil spring 630 (FIG. 14) also rests against cover 253 to bias ridge 622 against outer side wall 600b. FIG. 14 shows the parts assembled. Ridge 622 is pressed against outer side wall 600b (FIG. 11) of gear 145.

Both the coil spring 604 and ridge 622 contact a light grease, recommended for spring clutches, located where they contact the roller 49 assembly. For element 620, the grease is applied after assembly through hole 628. Spring 604 has grease where it surrounds stud 602. The grease smoothes overall operation. The drag from the spring clutch is very uniform and in an amount defined by the tightness of the inner diameter of spring 604 against stud 602. The drag from element 622 is uniform because of the grease.

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Variations and alternative will be apparent and can be anticipated.

We claim:

1. An apparatus for electrophotographic imaging comprising

a photosensitive roller assembly mounted for rotation in said apparatus,

a gear integral with said assembly for receiving torque from a meshing gear to cause said rotation of said assembly during imaging, and

a uniform frictional drag element in contact with said assembly at a location which receives torque from said gear integral with said assembly, said drag element applying friction forces which oppose said rotation.

2. An apparatus for electrophotographic imaging comprising

a photosensitive roller assembly mounted for rotation in said apparatus on a central shaft, said assembly having a stud surrounding said central shaft,

a gear integral with said assembly for receiving torque from a meshing gear to cause said rotation of said assembly during imaging, said rotation transmitting torque to said stud, and

a coil spring clutch wound around said stud, the direction of winding of said spring being that which unwinds said spring during said rotation.

3. The apparatus as in claim 2 also comprising

a first and a second washer between said spring and said assembly said first washer contacting said spring and said second washer,

said second washer contacting said assembly,

said washers having coefficients of friction less than the surfaces they contact so that the washer contacting the spring clutch does not move while the washer contacting said assembly does move with said assembly.

4. The apparatus as in claim 3 also comprising a grease located between said spring clutch and said stud.

5. The apparatus as in claim 2 also comprising a grease located between said spring clutch and said stud.

6. An apparatus for electrophotographic imaging comprising

a photosensitive roller assembly mounted for rotation in said apparatus,

a gear integral with said assembly for receiving torque from a meshing gear to cause said rotation of said assembly during imaging,

a frictional surface located to press against said assembly at a location which receives torque from said gear integral with said assembly to uniformly resist said rotation, and

a grease located between said frictional surface and said assembly.

7. The apparatus as in claim 6 in which said assembly has an integral side wall and said frictional surface is a flat surface biased against said side wall.

\* \* \* \* \*

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# THE UNITED STATES OF AMERICA

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January 19, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: 6,078,771

ISSUE DATE: June 20, 2000

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



*W. Montgomery*  
W. MONTGOMERY  
Certifying Officer

US006078771A

**United States Patent** [19]**Buchanan et al.**[11] **Patent Number:** **6,078,771**[45] **Date of Patent:** **Jun. 20, 2000**[54] **LOW FRICTION DOCTOR BLADE**

[75] Inventors: **John Andrew Buchanan; Benjamin Keith Newman**, both of Lexington;  
**Franklin Joseph Palumbo**,  
 Nicholasville, all of Ky.

[73] Assignee: **Lexmark International, Inc.**,  
 Lexington, Ky.

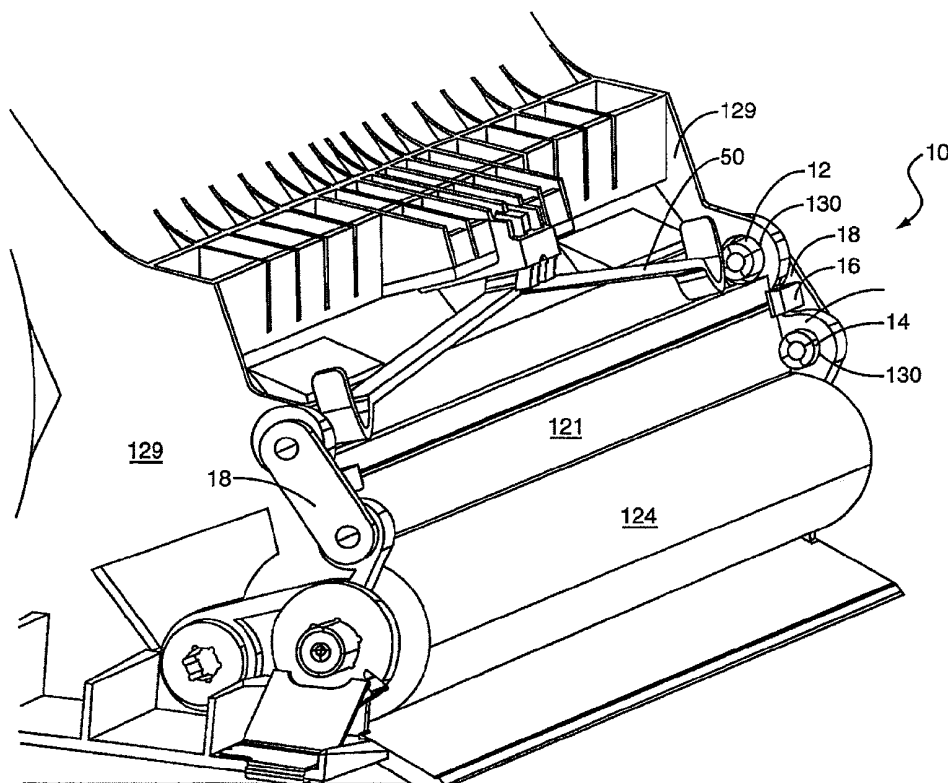
[21] Appl. No.: **09/401,150**[22] Filed: **Sep. 22, 1999**[51] **Int. Cl.**<sup>7</sup> ..... **G03G 15/08**[52] **U.S. Cl.** ..... **399/284; 118/261**[58] **Field of Search** ..... **399/284, 274,**  
**399/126, 350, 351, 102, 103, 105; 118/261**[56] **References Cited****U.S. PATENT DOCUMENTS**

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*Primary Examiner*—Sophia S. Chen*Attorney, Agent, or Firm*—Michael T. Sanderson[57] **ABSTRACT**

A device within an image forming apparatus for positioning a doctor blade against a developer roller and preventing toner leakage. The device includes a developer housing for containing the developer roller and the doctor blade. A biasing member is positioned adjacent to the doctor blade for forcing the doctor blade against the developer roller for controlling the mass flow and charge level of the toner. The doctor blade is supported by retention stops on a front edge and a pair of supports on the back edge. Toner is prevented from leaking through the device by a flap seal positioned along the doctor blade back side and a seal positioned between each end of doctor blade end and developer housing. The invention provides for the doctor blade to be freely positioned between the retention stops, developer housing, and seals providing for the doctor blade to contact the developer roller in a consistent manner.

**17 Claims, 7 Drawing Sheets**



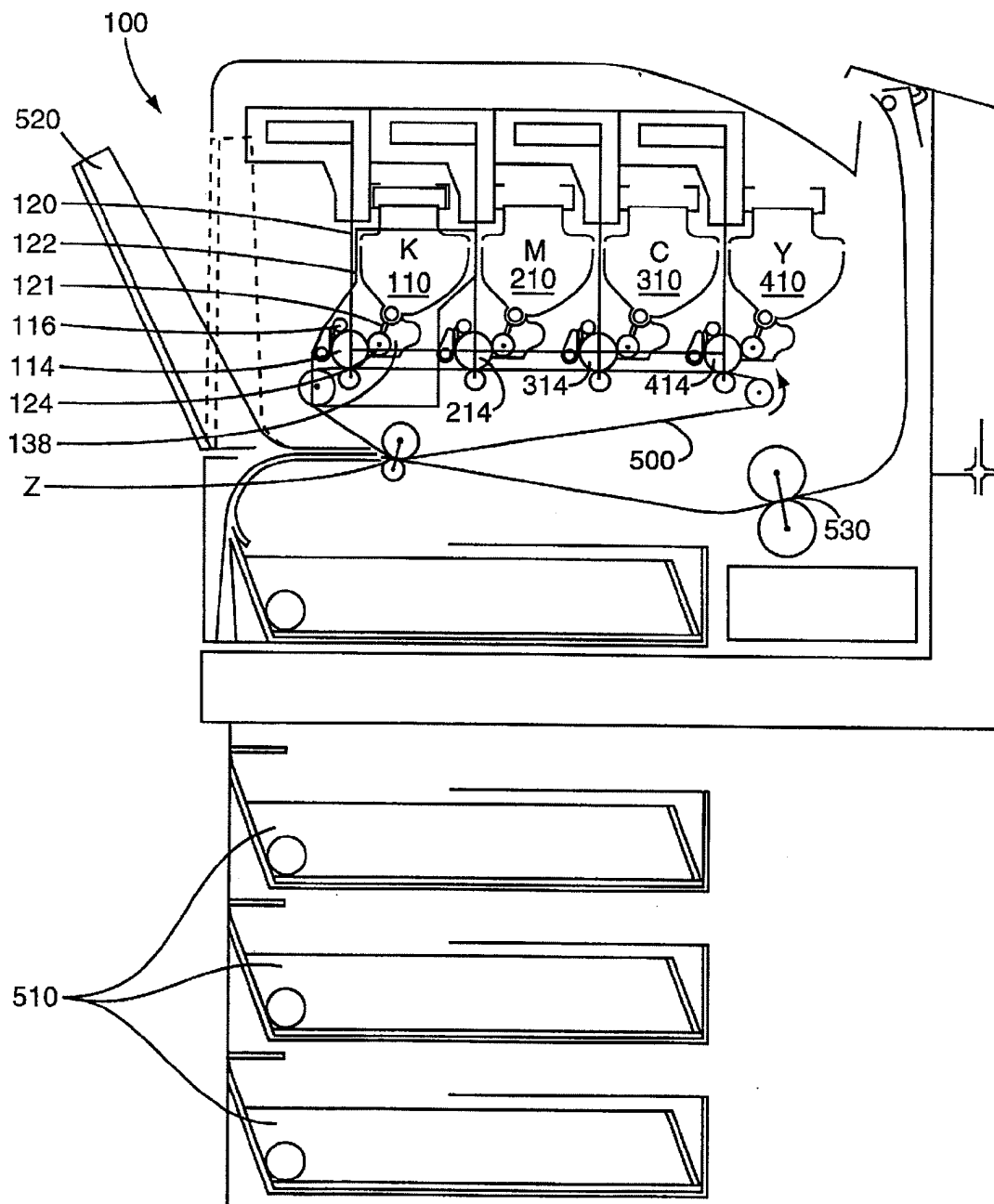


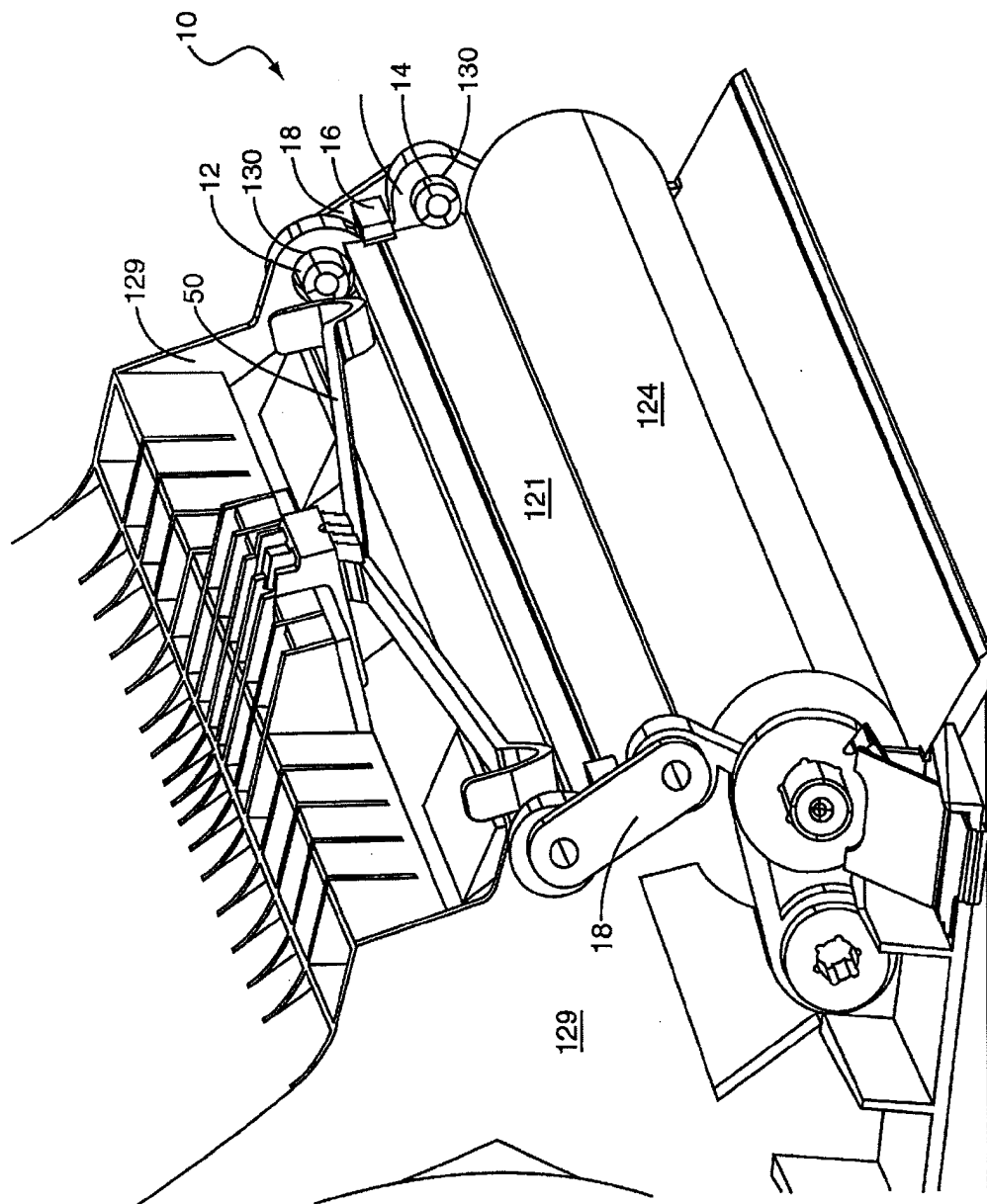
FIG. 1

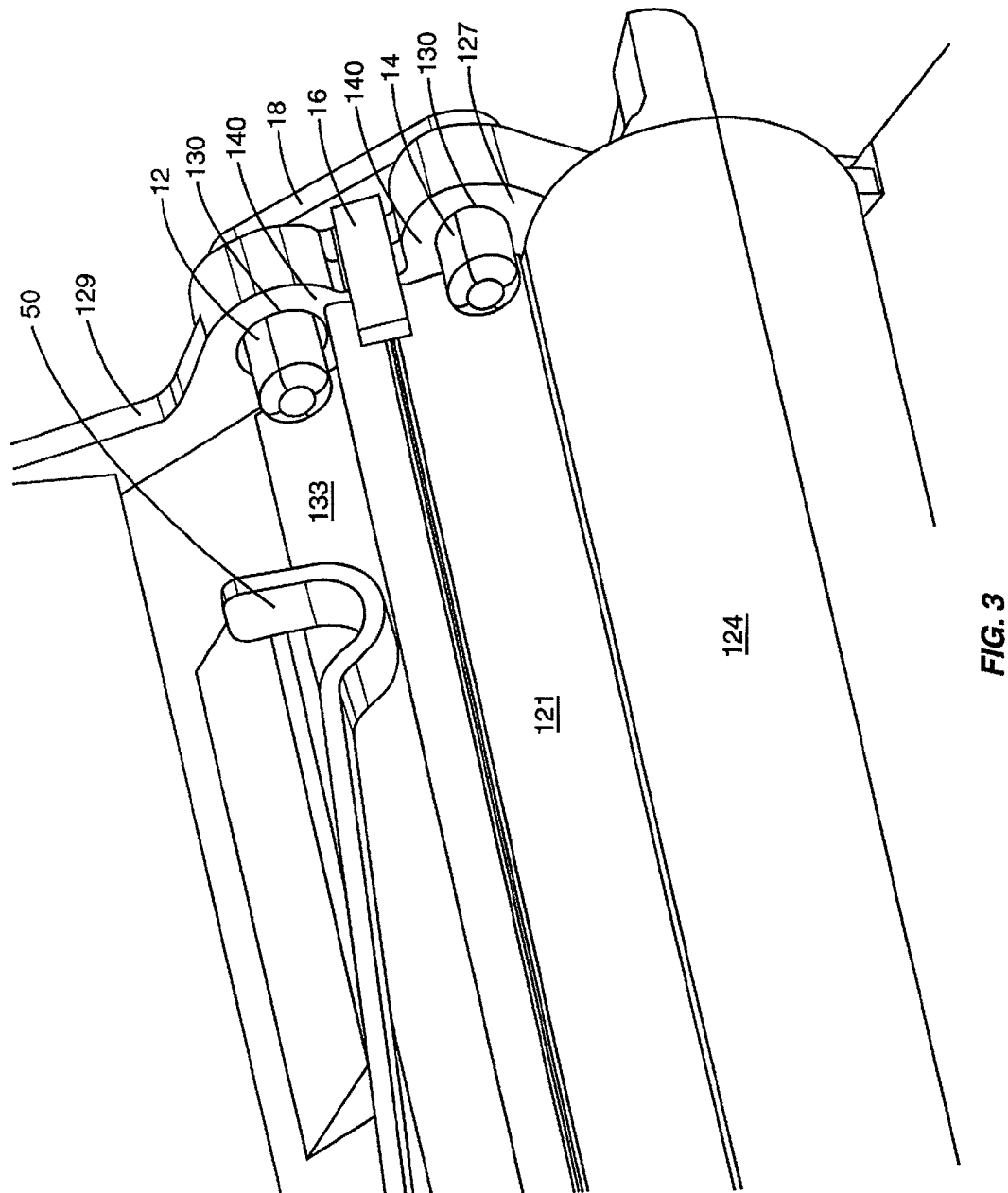
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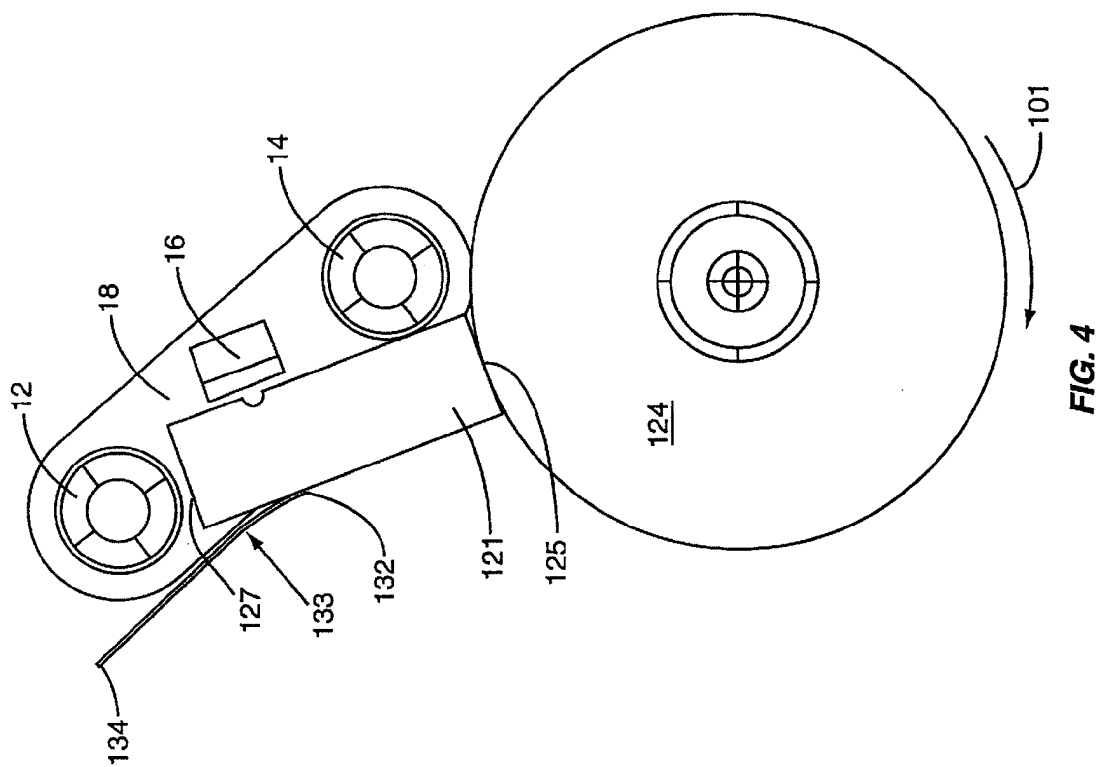
**Jun. 20, 2000**

**Sheet 2 of 7**

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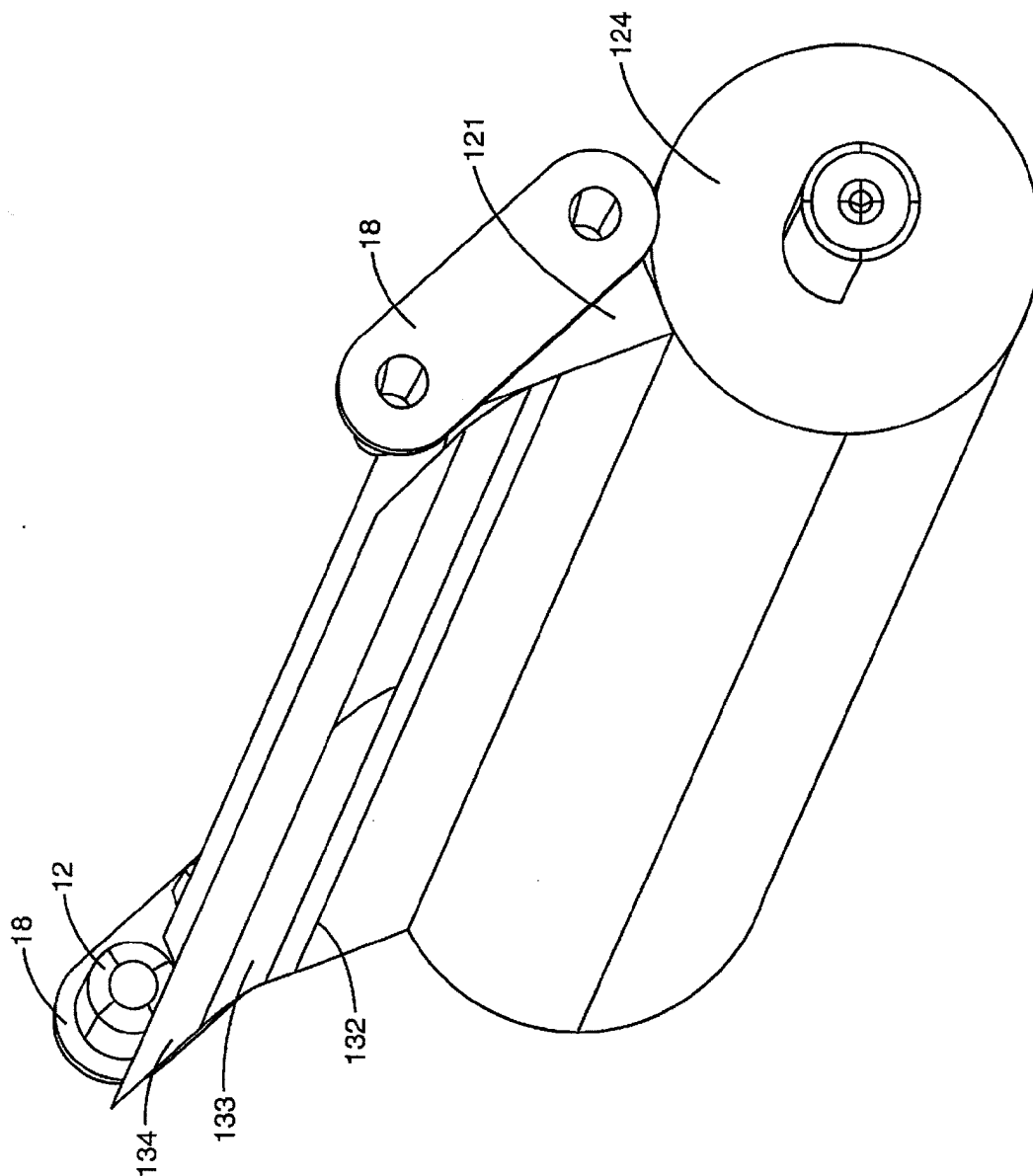


FIG. 5

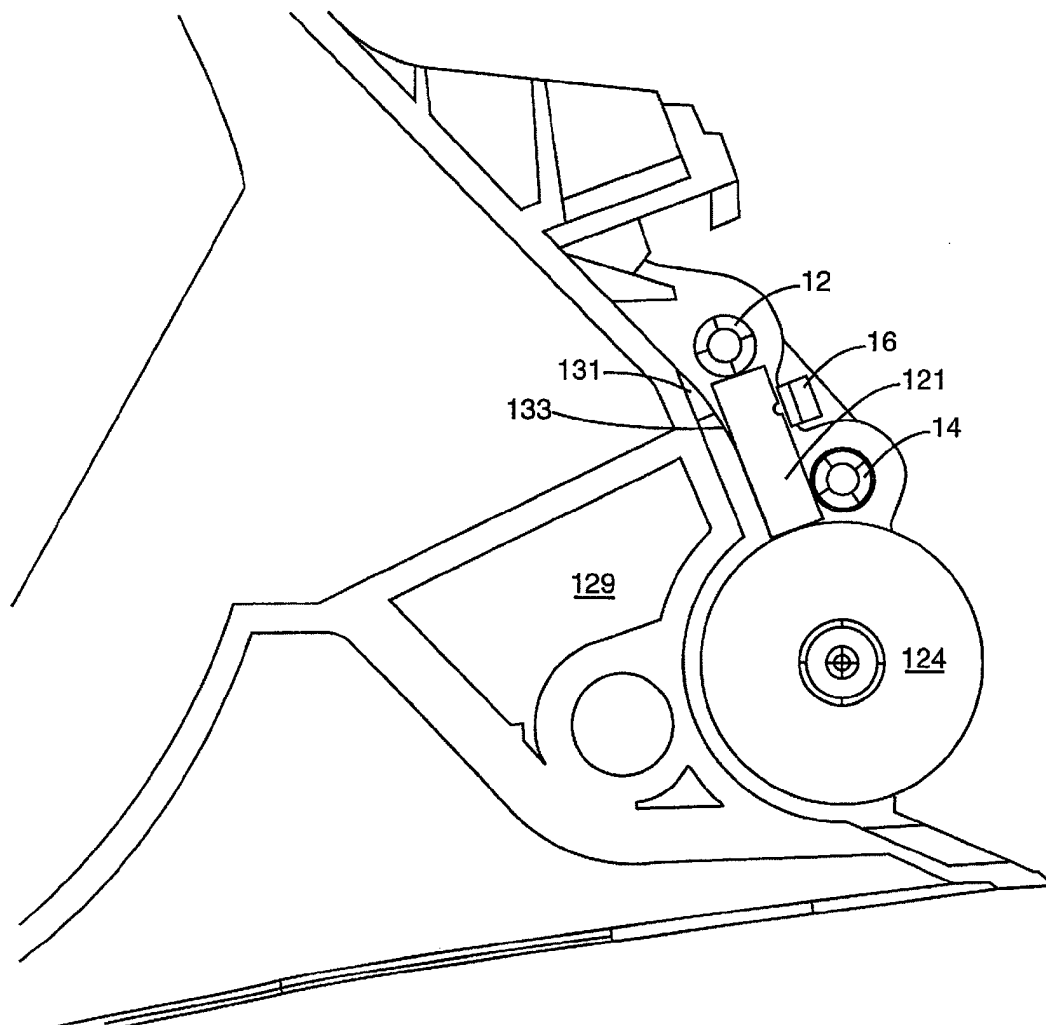
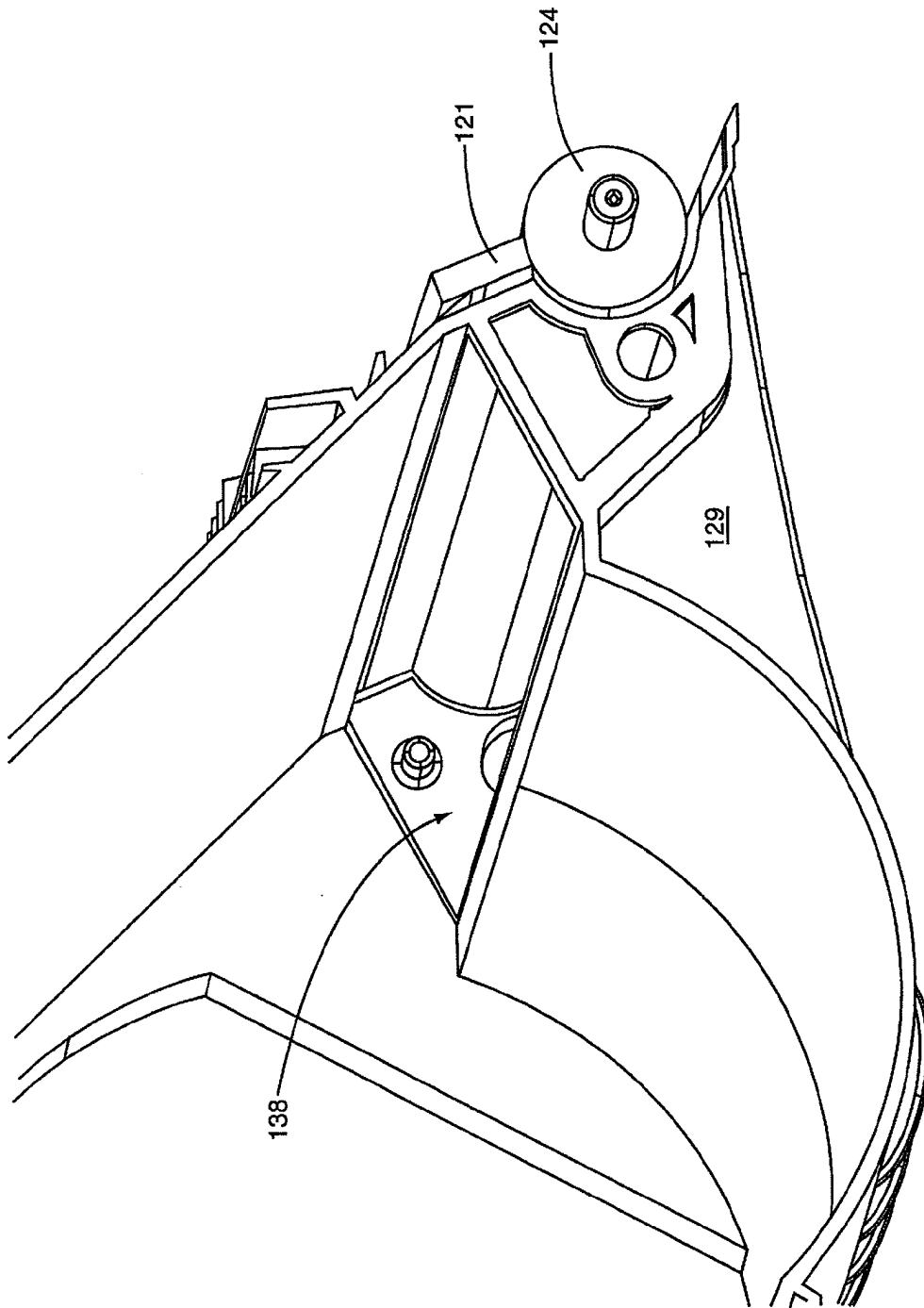


FIG. 6





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## LOW FRICTION DOCTOR BLADE

### FIELD OF THE INVENTION

The present invention relates generally to an image forming apparatus and, more particularly, to a doctor blade positioned against a developer roller to evenly meter toner while preventing loss of toner.

### BACKGROUND OF THE INVENTION

Image forming devices including copiers, laser printers, facsimile machines, and the like, include a drum having a rigid cylindrical surface that is coated along a defined length of its outer surface with a photoconductive material. The surface of the drum is charged to a uniform electrical potential and then selectively exposed to light in a pattern corresponding to an original image. Those areas of the photoconductive surface exposed to light are discharged thus forming a latent electrostatic image on the photoconductive surface. A developer material, such as toner, having an electrical charge such that the toner is attracted to the photoconductive surface is brought into contact with the member's photoconductive surface. The drum then rotates past an intermediate transfer medium where the toner is transferred onto the medium. A recording sheet, such as a blank sheet of paper, is then brought into contact with the intermediate transfer medium and the toner thereon is transferred to the recording sheet in the form of the latent electrostatic image. The recording sheet is then heated thereby permanently fusing the toner to it. In preparation for the next image forming cycle, the member's photoconductive surface is discharged and residual toner is removed.

The toner is stored in a toner reservoir adjacent to the drum. A doctor blade and developer roller are positioned between the toner reservoir and drum for controlling the amount of toner passed to the drum surface. The nip point created between the doctor blade and the developer roller controls the amount of toner transferred to the drum surface. Additionally, the developer roller and doctor blade are electrically charged to charge the toner as it passes through the nip point to assist in the transfer to the drum.

It is important that the doctor blade make uniform and consistent contact across the entire length of the developer roller. If the doctor blade has inconsistent pressure with the developer roller during the transfer, uneven toner amounts will be transferred to the drum resulting in inconsistent and unacceptable print quality. If too much toner is transferred to the drum, printing errors may occur such as blurred images, poor color, and toner particles deposited on the background areas. Conversely, if not enough toner is transferred to the drum, the images will be too light and difficult to see.

A problem in maintaining consistent contact and pressure is the developer roller profile may be non-uniform requiring that the doctor blade move inward and outward to track the surface of the developer roller. Additionally, it is vital that contact be maintained across the entire length of the doctor blade to ensure even print quality across the width of the image. Therefore, it is important that the doctor blade contact and "float" on the developer roller with a consistent amount of pressure for correct toner transfer and toner charge.

One type of previous design permanently mounts the doctor blade against a housing positioned adjacent to the developer roller surface. This design provides for the doctor blade placement to be constant regardless of the surface of the developer roller. However, this design does not address variations and irregularities in the developer roller surface

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resulting in greater or less amounts of toner to pass by the doctor blade to the drum surface.

Another design provides for the doctor blade to be positioned within a housing adjacent to the developer roller. The doctor blade is attached to the housing to secure the doctor blade in the proper position and angle relative to the developer roller surface. A biasing member positioned behind the doctor blade pushes the doctor blade against the developer roller. One drawback of this design is the doctor blade rubs against the housing during use resulting in friction between the surfaces. This friction reduces the effectiveness in metering toner because a portion of the force by the biasing member is required to overcome the friction and is not available to hold the doctor blade against the developer roller surface. Additionally, as the doctor blade moves inward and outward relative to the developer roller, the friction acts to dampen the blade movement, which results in inaccurate surface tracking.

Another drawback of previous designs is toner leakage around the doctor blade and housing. The contact surfaces between the doctor blade and the housing provide avenues for the toner to collect and pass through to the drum surface resulting in print defects. To overcome this problem, seals may be applied between the edges of the doctor blade and the housing to eliminate toner leakage. Unfortunately, the seals affect the movement of the blade against the developer roller resulting in yet additional force requirement to push the blade against the roller. Additionally, putty is often applied to these areas to further assist in blocking any openings. However, putty causes additional friction between the doctor blade and housing.

Thus, there remains a need for a doctor blade that floats on the developer roller providing consistent toner amounts to be passed to the drum surface.

### SUMMARY OF THE INVENTION

The present invention provides for positioning a doctor blade against a developer roller within an image forming apparatus. The doctor blade is held in position adjacent to the developer roller along first and second ends by a developer housing for controlling lateral movement. A pair of retention posts and retention blocks are positioned along the front side of the doctor blade, and a pair of supports are positioned along the back side to control the angular position of the doctor blade relative to the developer housing. A pair of stop members are positioned above the doctor blade opposite the developer roller to control the maximum movement of the doctor blade away from the developer roller. These elements contain the doctor blade relative to the developer roller without being attached to otherwise inhibit the movement of the doctor blade. These members are preferably constructed of a low friction material that provides for the doctor blade to freely move and stay in contact with the developer roller. A biasing member forces the doctor blade against the developer roller and controls the pressure at a nip point to control the mass flow and charge level of the transferred toner.

The invention may also prevent toner from leaking from the toner reservoir to the drum. A flap seal is positioned along the back edge of the doctor blade to prevent toner from leaking over the top edge of the doctor blade. Additional, seals are positioned at the contact points between the developer housing and the developer roller. These seals contact the doctor blade to prevent toner leakage, and are preferably constructed of a low friction material such that the movement of the doctor blade is not restricted.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view illustrating the elements of an image forming apparatus and the positioning of the doctor blade and developer roller;

FIG. 2 is a perspective view illustrating a front side of the doctor blade positioned against the developer roller in accordance with the present invention;

FIG. 3 is a partial perspective view illustrating the edge of the doctor blade seated against the developer housing with the stop post, retention post, and retention block;

FIG. 4 is a side view illustrating the doctor blade and the developer roller removed from the developer housing;

FIG. 5 is a perspective view removed from the developer housing of the doctor blade and developer roller having a flap seal positioned along the back edge of the doctor blade;

FIG. 6 is a side view illustrating the doctor blade and developer roller mounted within the developer housing; and

FIG. 7 is a perspective view illustrating the lower toner reservoir adjacent to the doctor blade and developer roller.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates the basic elements of an image forming device and is incorporated for an understanding of the overall electrophotographic image forming process. A color laser printer is illustrated as 100, however, one skilled in the art will understand that the present invention is applicable to other types of image forming devices using toner for printing through a photoconductive drum. The image forming apparatus, generally designated 100, includes a plurality of similar toner cartridges 110, 210, 310, and 410. Each toner cartridge has similar construction but is distinguished by the toner color contained therein. In the preferred embodiment, the device includes a black cartridge 110, a magenta cartridge 210, a cyan cartridge 310, and a yellow cartridge 410. The different color toners form individual images of a single color that are combined in layered fashion to create the final multi-colored image.

Each of the toner cartridges is substantially identical and includes a drum, a transfer device, and a cleaning device. As the cartridges are respectively identical except for the toner color, the cartridge and elements for forming black images will be described, with the other color image forming units being omitted for simplification.

The drum 114 is generally cylindrically-shaped with at least one end having gears or spokes for intermeshing with the image forming device drive gears to provide for a rotational force. The drum 114 has a smooth surface for receiving an electrostatic charge over the surface as the drum rotates past charging roller 116. The drum 114 uniformly rotates through a laser scanning assembly 120 that directs a laser onto a selected portion of the drum surface forming an electrostatically latent image across the width of the drum representative of the outputted image. A drive gear rotates the drum at a constant speed as the laser is scanned across the width segment. This process continues as the entire image pattern is formed on the drum surface.

After receiving the latent image, the drum rotates through a toner area having a toner bin 122 and a lower toner reservoir 138 for housing the toner. A developer roller 124 is positioned adjacent to the doctor blade and rotates to transfer the toner from the lower toner reservoir 138 to the drum 114. The doctor blade 121 is biased against the developer roller 124 at a nip point that controls the amount of toner transferred to the drum 114. Additionally, both the

developer roller 124 and doctor blade 121 are electrically charged to place a charge on the toner that passes through the nip point to further assist in the transfer. It is important that the doctor blade 121 continuously maintain contact or float against the developer roller 124 to maintain consistent pressure providing for a consistent amount of toner transfer and also providing a consistent charge to the toner. The toner is a fine powder usually constructed of plastic granules that are attracted and cling to the areas of the drum that have been discharged by the laser scanning assembly 120.

The drum next rotates past an adjacently-positioned intermediate transfer medium belt 500 (hereinafter, ITM belt) where the toner is transferred from the drum 114. As illustrated in FIG. 1, the ITM belt 500 is endless and extends around a series of rollers adjacent to the drums. The ITM belt 500 and the image on each drum 114, 214, 314, 414 are synchronized providing for the toner from each drum to precisely align on the ITM belt during a single pass. By way of example as viewed in FIG. 1, the yellow (Y) toner will be placed on the ITM belt, followed by cyan (C), magenta (M), and black (B). After depositing the toner on the ITM belt, the drum rotates through a cleaning area where residual toner is removed from the surface via a brush or scraper 126.

As the drums are being charged and gathering toner, a recording sheet, such as blank sheet of paper, is being routed to intercept the ITM belt 500. The paper may be placed in one of the lower trays 510, or introduced into the image forming device through a side track tray 520. A series of rollers and belts transports the paper to point Z where the sheet contacts the ITM belt and receives the toner. Preferably, voltage is applied to one of the rollers that pushes the sheet of paper against the ITM belt at point Z to pull the charged toner away from the belt and onto the paper. The sheet and attached toner next travel through a fuser 530 having a pair of rollers and a heating element that heats and fuses the toner to the sheet. The paper with fused image is then transported out of the printer for receipt by a user.

FIG. 2 illustrates the doctor blade 121 positioned against the developer roller 124. An up-stop/retention device, generally designated 10, positions the doctor blade 121 and includes a stop post 12 for controlling the amount of doctor blade movement away from the developer roller 124. A retention post 14 and retention block 16 contact and position the doctor blade 121 relative to the developer roller 124.

The stop post 12 is positioned above the doctor blade 121 opposite the developer roller 124 and functions to control the maximum movement of the doctor blade 121 away from the developer roller 124. The stop post 12 is especially effective for safety concerns during handling of the cartridge to keep the doctor blade within the cartridge. By way of example, if the cartridge is dropped, the stop post 12 prevents the doctor blade 121 from separating from the developer housing 129 and possibly damaging the cartridge, image forming apparatus, or injuring a person handling this equipment.

A biasing member 50 attached to the developer housing 129 is positioned above the doctor blade to maintain a continuous force for biasing the lower edge 125 of the doctor blade against the developer roller 124. The drawings illustrate the doctor blade 121 substantially perpendicular to the developer roller, however, other orientations may also provide for transfer of proper toner amounts. Preferably, the biasing member 50 contacts the doctor blade 121 at more than one location along the doctor blade to ensure an even and distributed force is applied across the entire width of the developer roller 124. In one embodiment, the biasing member 50 provides about 1400 grams of force to the developer roller 124.



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The retention post 14 and retention block 16 function to maintain the doctor blade 121 in the proper orientation with the doctor blade lower edge 125 positioned against the developer roller 124. As the developer roller 124 rotates in the direction illustrated by arrow 100 in FIG. 4, the doctor blade 121 is pushed against the retention post 14 and retention block 16. The post 14 and block 16 work in combination and the doctor blade 121 may contact only one or both during the toner transfer process. Both the stop post 12 and retention post 14 are illustrated as having a generally circular cross-sectional shape and the retention block 16 has a generally rectangular shape. However, other shapes may also function to effectively control the positioning of the doctor blade 121 providing the shapes do not cause friction with the doctor blade that would restrict the movement against the developer roller 124.

The stop post 12, retention post 14, and retention block 16 may be constructed as a unitary piece having a common back section 18. Preferably, the piece is constructed of a low friction material, and in one preferred embodiment the piece is constructed from acetal. As illustrated in FIGS. 2 and 3, the back section 18 does not contact the doctor blade 121 but is positioned behind the developer housing 129. The stop post 12 and retention post 14 extend through openings 130, and the retention block 16 extends around the edge of the developer housing 129. The distance the stop post 12, retention post 14, and retention block 16 extend outward from the back section 18 may vary providing they extend through and around the developer housing for maintaining the position of the doctor blade 121.

The developer housing 129 functions to contain the toner and provide a structure for mounting the doctor blade 121 and developer roller 124. As illustrated in FIGS. 1 and 7, a lower toner reservoir 138 houses the toner adjacent to the developer roller 124 and doctor blade 121. The lower toner reservoir 138 extends the entire length of the developer roller 124 to ensure toner is transferred across the entire length of the roller. The developer housing 129 further extends along the outer edges of the doctor blade 126 as illustrated in FIGS. 2 and 3. The developer housing has an inner side wall 140 that provides for laterally maintaining the doctor blade 121 over the developer roller 124. The developer housing 129 further includes a pair of apertures 130 for mounting the stop post 12 and retention post. The developer housing 129 may be constructed of any rigid material for supporting the toner and doctor blade 121, and in one embodiment is constructed of polystyrene.

Preferably, the inner side wall 140 further includes a seal (not shown) positioned where the doctor blade 121 contacts the inner side wall for ensuring toner does not leak between these elements. In one embodiment, a polyester film seal is positioned along the inner side wall 140, or positioned within an indent within the side wall for placement adjacent to the doctor blade 121.

As illustrated in FIG. 6, a support 131 extends outward from the developer housing 129 for supporting the back edge of the doctor blade. Preferably, a support 131 is positioned adjacent to each edge of the doctor blade 121 to act in combination with the retention post 14 and retention block 16 to maintain the orientation of the doctor blade. As the developer roller 124 rotates, the doctor blade 121 may shift relative to the developer roller between the retention post 14, retention block 16, and support 131. In the embodiment illustrated in FIG. 6, the support 131 has a substantially triangular shape, although other shapes and sizes may also be used.

A flap seal 133 extends along the back side of the doctor blade 121 to prevent the toner from leaking from the lower

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toner reservoir 138 to the developer roller 124 and ultimately the drum 114. The flap seal 133 includes an upper edge 134 that is attached to the developer housing to prevent toner from leaking across the top edge 127 of the doctor blade. A bottom edge 132 extends along the doctor blade to prevent toner from leaking along the back edge of the doctor blade. The flap seal 133 is positioned against the back edge of the doctor blade, but is not attached as this would inhibit the doctor blade 121 from floating against the developer roller 124. As illustrated in FIG. 6, the flap seal 133 is positioned between the supports 131 and the doctor blade 121. The material of the flap seal provides for a low to zero friction contact between the doctor blade 121 both at the bearing surface at the supports 131 and along the doctor blade length. Preferably, the flap seal is constructed of a polyester film such as that sold under the trademark Mylar by DuPont. However, other low friction materials may also be used.

In use, as the developer roller rotates in the direction of arrow 100 illustrated in FIG. 4, toner from the lower toner reservoir 138 is transferred at the nip point between the lower edge 125 of the doctor blade and the developer roller 124. The pressure of the doctor blade 121 against the developer roller 124 controls the mass flow and charge level of the toner. The biasing member 50 provides a predetermined force on the doctor blade that is transferred to the nip point. Because of non-uniform profile of the developer roller 124, the doctor blade 121 may move in and out. Because there is little to no friction between the doctor blade 121 and any surface, the force of the biasing member 50 is transferred directly to the nip point to provide a consistent pressure resulting in uniform toner amounts and toner charge being passed to the drum 114. The doctor blade is not restricted by any of the components maintaining its position or sealing the toner and can thus effectively float on the surface of the developer roller. The doctor blade 121 may be positioned at a variety of angles relative to the developer roller 124.

#### EXAMPLE

Testing was performed to determine the amount of friction between the edges of the doctor blade and the sides of the developer housing. Gear side refers to the side of the cartridge mounted to the drive gears when the cartridge is inserted into the image forming apparatus. Likewise, the non-gear side is the side positioned away from the drive gears when mounted in the cartridge.

| Cartridge Serial No. | Gear Side (g) | Non-Gear Side (g) |
|----------------------|---------------|-------------------|
| 1                    | 140           | 210               |
| 2                    | 125           | 200               |
| 3                    | 135           | 215               |
| 4                    | 210           | 320               |
| 5                    | 125           | 210               |
| 6                    | 175           | 250               |
| 7                    | 130           | 250               |
| 8                    | 110           | 180               |
| 9                    | 125           | 225               |
| 10                   | 125           | 170               |
| 11                   | 100           | 150               |
| 12                   | 175           | 250               |
| 13                   | 150           | 225               |
| X1                   | 0             | 0                 |
| X2                   | 0             | 0                 |

Using cartridge 1, 350 (140+210) grams of force is required to overcome the friction between the doctor blade

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and the developer housing to maintain contact with the developer roller. Therefore, if the spring provides about 1400 grams of force against the doctor blade, only 1,050 grams of force is being transferred to the developer roller. However, in the X1 and X2 embodiments constructed according to the present invention, the friction against the doctor blade has been eliminated resulting in the force of the spring being transferred directly to the developer roller without any loss.

The friction resulting in cartridges 1-13 was mainly caused by the seals extending between the doctor blade and the developer housing, and putty inserted along the seals to further prevent toner leakage. Because the new design eliminates these seals and the need for putty, there was no friction between these parts.

In this description, like-reference characters designate like or corresponding parts throughout the several views. Also in the following description, it is to be understood that such terms as "forward," "rearward," "left," "right," "upwardly," "downwardly," and the like, are words of convenience and are not to be construed as limiting terms. Certain modifications and improvements will occur to those skilled in the art upon a reading of the foregoing description. It should be understood that all such modifications and improvements have been deleted for the sake of conciseness and readability but are properly within the scope of the following claims.

What is claimed is:

1. A retainer for positioning a doctor blade against a developer roller within an image forming apparatus, said retainer comprising:

- a. a front retention member positioned adjacent to a front side of the doctor blade;
- b. a top retention member positioned on a top edge of the doctor blade; and
- c. a biasing member to bias the doctor blade against the developer roller; wherein the doctor blade is moveably contained within the retainer and rotation of the developer roller biases the doctor blade against said front retention member to maintain the orientation of the doctor blade and allow the doctor blade to track the developer roller.

2. The retainer of claim 1, further including side walls positioned against first and second doctor blade ends to position the doctor blade against the developer roller.

3. The retainer of claim 1, further including at least one support positioned on a back side of the doctor blade for maintaining the orientation of the doctor blade.

4. The retainer of claim 3, further including a seal contacting the doctor blade along the back side to prevent toner leakage, said seal extending between the doctor blade and said at least one support.

5. The retainer of claim 1, wherein said front retention member and said top retention member are a unitary piece.

6. A retainer for positioning a doctor blade within an image forming apparatus, said retainer comprising:

- a. a housing extending along each end of the doctor blade;
- b. a pair of retention members connected to said housing and positioned in proximity to each end of the doctor blade, each of said retention members having a reten-

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tion post positioned adjacent to a front edge of the doctor blade; and

- c. at least one support positioned adjacent to a back edge of the doctor blade; wherein the doctor blade is freely contained between said housing, retention members, and at least one support to freely maintain contact with a developer roller.

7. The retainer of claim 6, wherein each of said retention members further includes a retention block positioned adjacent to the doctor blade front edge for controlling the positioning of the doctor blade.

8. The retainer of claim 7, wherein each of said retention members further includes a stop post positioned above the doctor blade opposite the developer roller to control the movement of the doctor blade from the developer roller.

9. The retainer of claim 8, wherein each of said retention members is constructed of acetal.

10. The retainer of claim 6, further including a biasing member for pushing the doctor blade against the developer roller.

11. The retainer of claim 10, wherein said biasing member pushes the doctor blade against the developer roller with a force of about 1400 grams.

12. The retainer of claim 6, further including a flap seal positioned along the doctor blade back edge for preventing toner escape, said flap seal extending between said at least one support and the doctor blade.

13. The retainer of claim 12, wherein said flap seal is constructed of a polyester film.

14. The retainer of claim 6, wherein a seal is mounted to said housing adjacent the doctor blade ends for preventing toner leakage.

15. A device for transferring toner to a developer roller and preventing toner leakage within an image forming apparatus comprising:

- a. a developer housing;
- b. a doctor blade positioned within the developer housing, said doctor blade having lateral edges and longitudinal edges with a first lateral edge being positioned to contact the developer roller for controlling the toner amount transferred from a toner reservoir to the developer roller;
- c. retention members positioned along front and back sides of said doctor blade for positioning said doctor blade;
- d. a biasing member contacting a second lateral edge of said doctor blade for forcing said first lateral edge doctor blade against the developer roller; and
- e. a flap seal positioned along said doctor blade back side for preventing toner leakage from said toner reservoir;
- f. wherein said doctor blade is freely positioned between said retention members and said developer housing providing for said doctor blade first lateral edge to contact the developer roller.

16. The device of claim 15, wherein said doctor blade is angled between about 0 and 90 degrees relative to the developer roller.

17. The device of claim 16, wherein said biasing member supplies about 1400 grams of force to said doctor blade.

\* \* \* \* \*

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# THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office

December 31, 2009

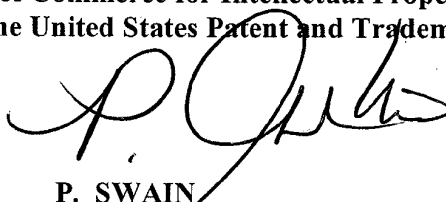
THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
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U.S. PATENT: 6,397,015

ISSUE DATE: May 28, 2002

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



  
P. SWAIN  
Certifying Officer



US006397015B2

(12) **United States Patent**  
**Curry et al.**(10) **Patent No.:** **US 6,397,015 B2**  
(45) **Date of Patent:** **\*May 28, 2002**(54) **ENCODED DEVICE HAVING POSITIONED INDICIA FOR USE WITH A TONER CARTRIDGE**(75) **Inventors:** **Steven Alan Curry**, Nicholasville;  
**Benjamin Keith Newman**, Lexington;  
**Earl Dawson Ward, II**, Richmond;  
**Phillip Byron Wright**, Lexington, all of KY (US)(73) **Assignee:** **Lexmark International, Inc.**, Lexington, KY (US)(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) **Appl. No.:** **09/871,226**(22) **Filed:** **May 31, 2001****Related U.S. Application Data**

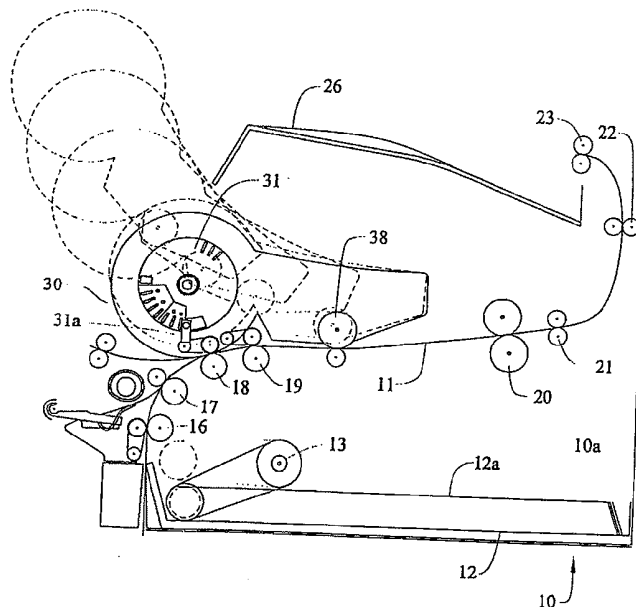
(63) Continuation of application No. 09/557,096, filed on Apr. 21, 2000, which is a division of application No. 09/415,620, filed on Oct. 12, 1999, now Pat. No. 6,169,860, which is a continuation of application No. 08/975,389, filed on Nov. 20, 1997, now Pat. No. 6,009,285, which is a continuation of application No. 08/768,257, filed on Dec. 17, 1996, now Pat. No. 5,995,772, which is a continuation-in-part of application No. 08/602,648, filed on Feb. 16, 1996, now Pat. No. 5,634,169.

(51) **Int. Cl.<sup>7</sup>** ..... **G03G 15/08**(52) **U.S. Cl.** ..... **399/12; 235/461; 399/27**(58) **Field of Search** ..... **399/24, 27, 262, 399/258, 119, 12; 235/461**(56) **References Cited****U.S. PATENT DOCUMENTS**3,047,675 A 7/1962 Berryhill ..... 179/100.3  
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JP 07306612 11/1995 ..... G03G/21/00*Primary Examiner*—Quana M. Grainger(74) *Attorney, Agent, or Firm*—John A. Brady; Ronald K. Aust(57) **ABSTRACT**

An encoded device for a toner cartridge provides a plate having preprogrammed indicia positioned at locations defined in relation to a clock face. The preprogrammed indicia includes a start indicia positioned at about a 6:00 o'clock position and at least one measurement indicia located between about 200 degrees and about 230 degrees from the 6:00 o'clock position.

**24 Claims, 17 Drawing Sheets**

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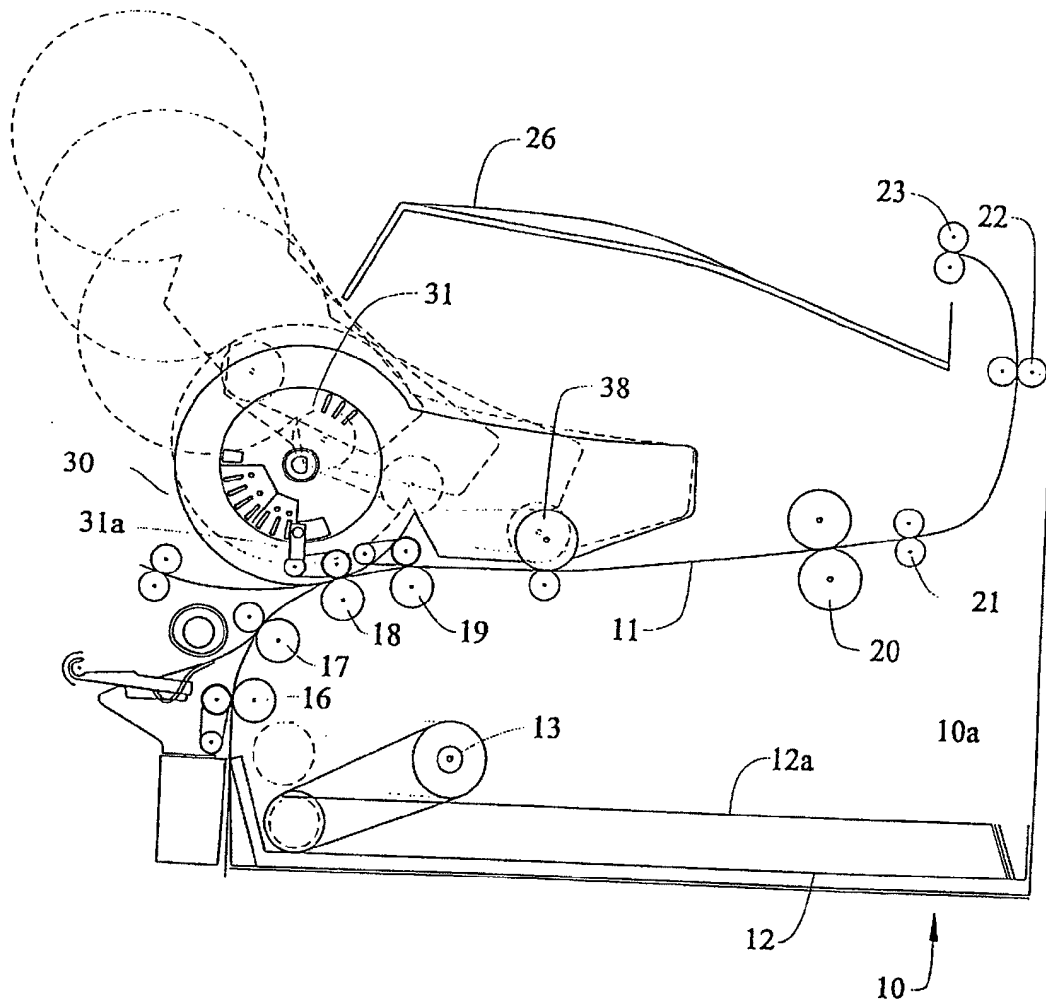
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FIG. 1



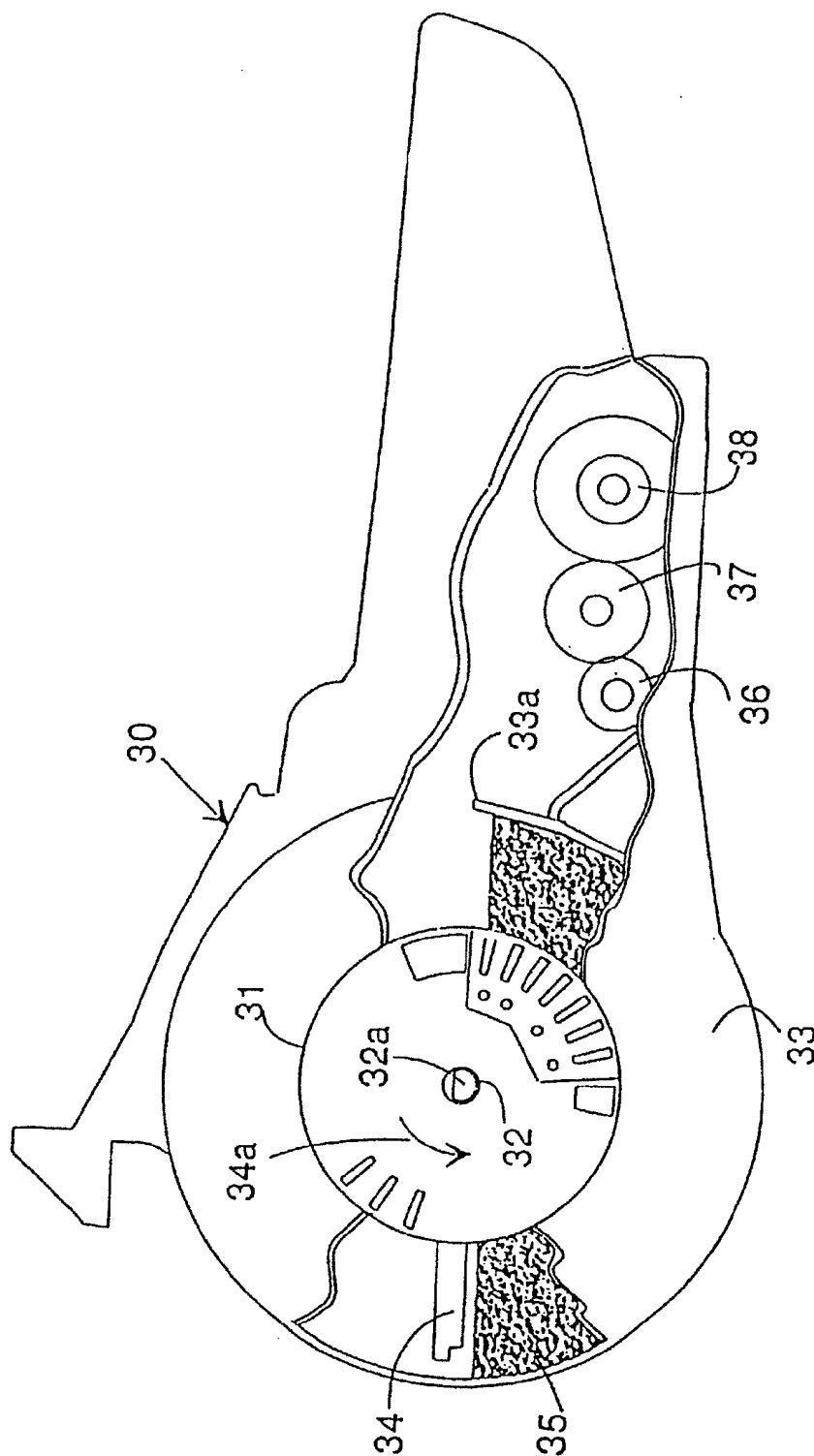


Fig. 2

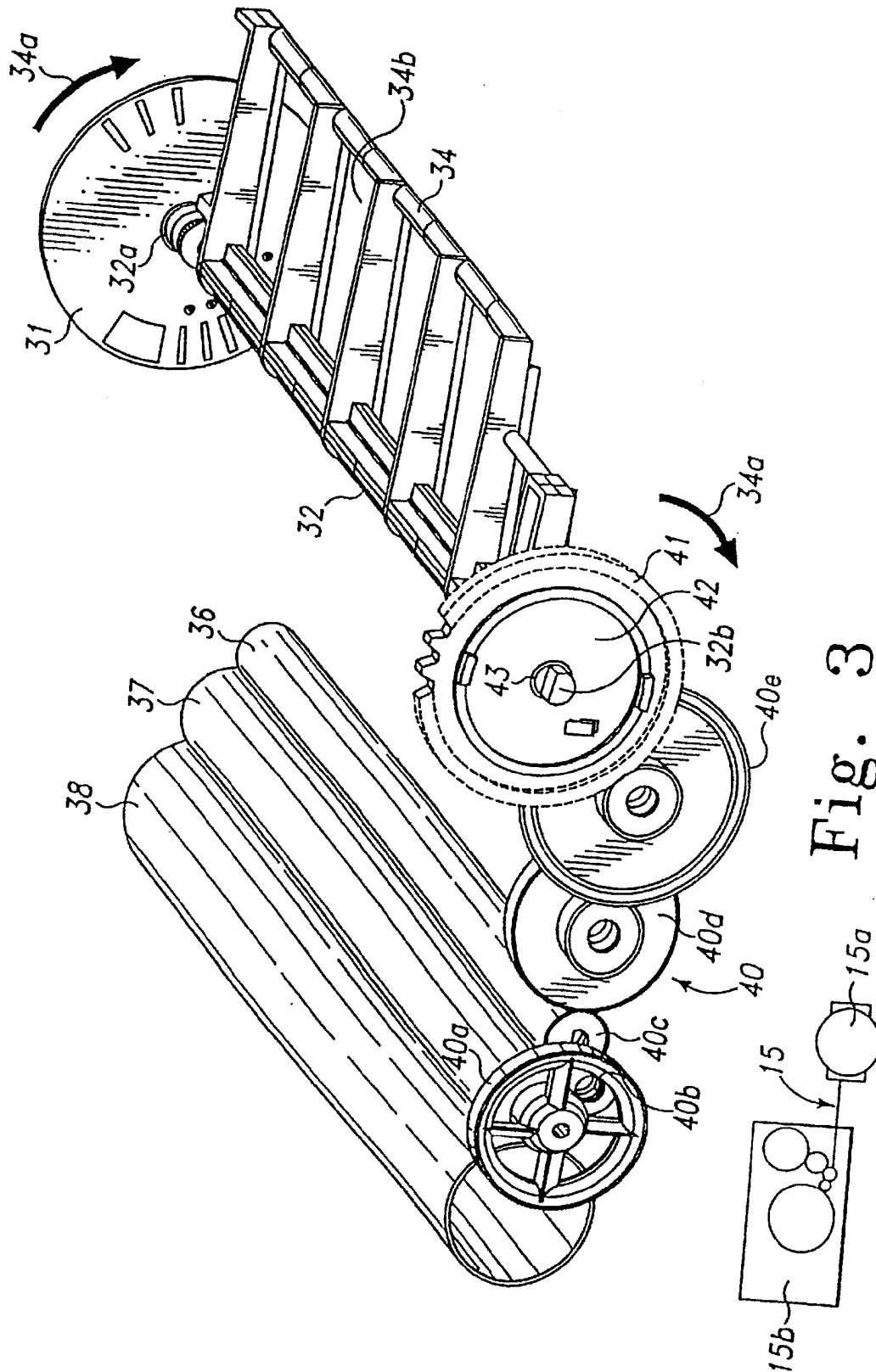


Fig. 3

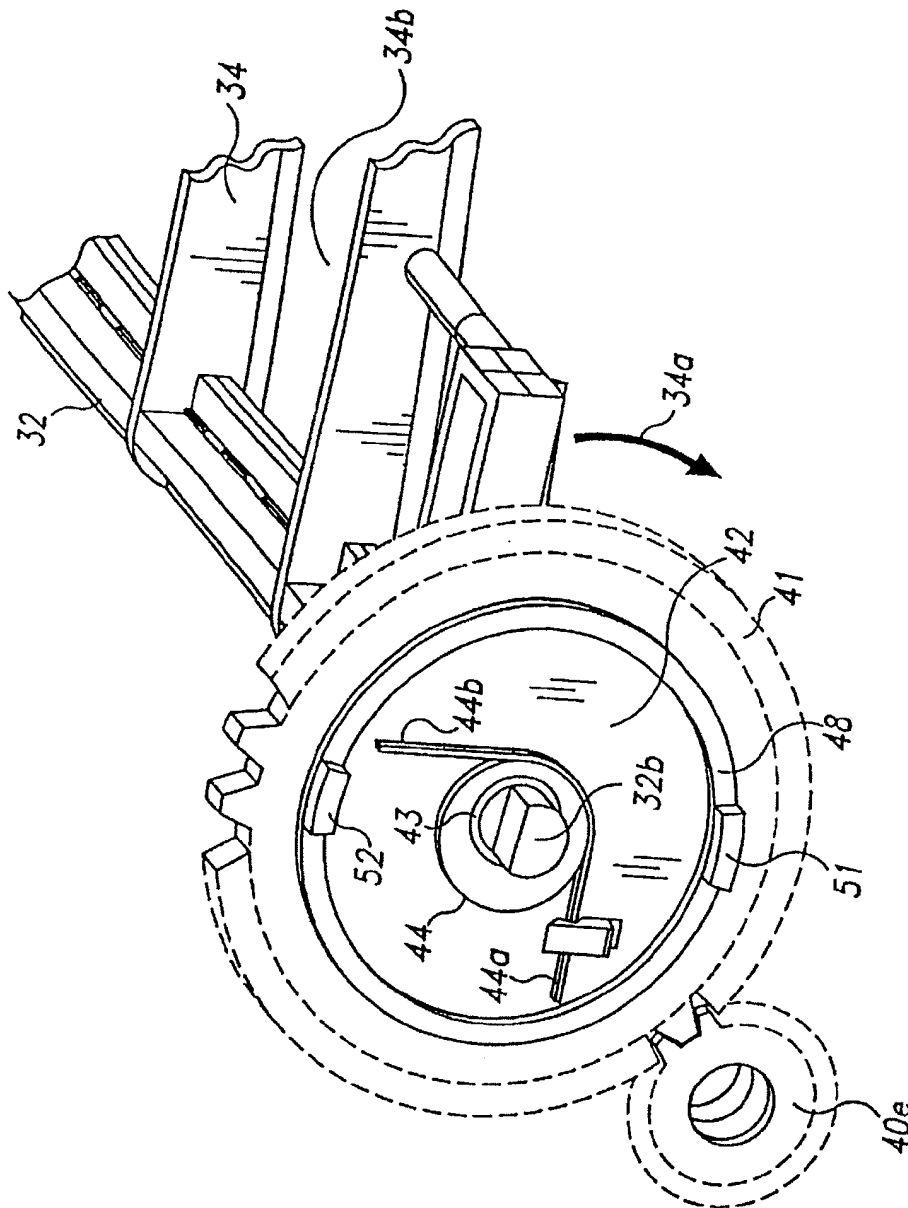


Fig. 4



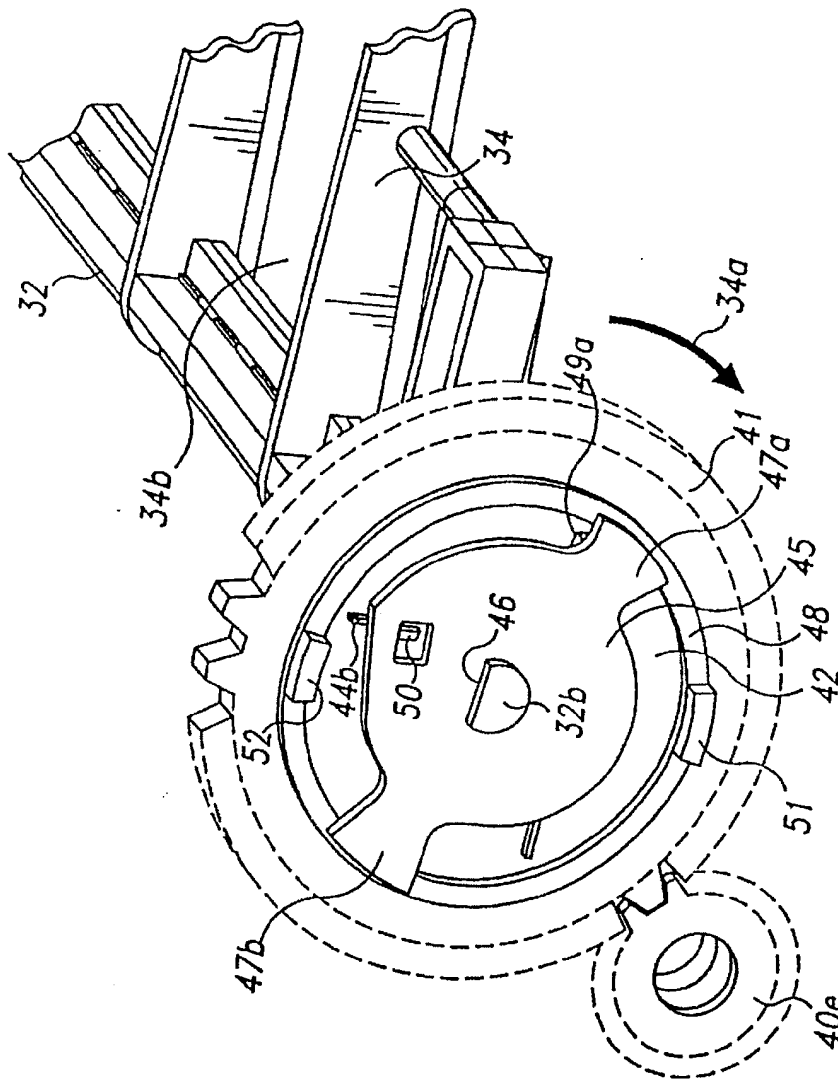


Fig. 5A

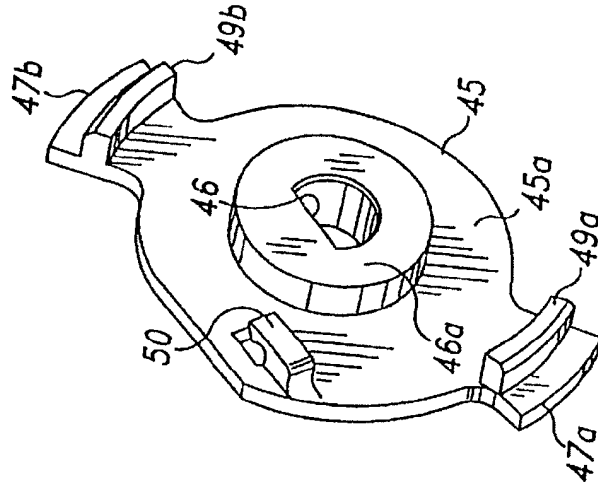


Fig. 5B

FIG. 6

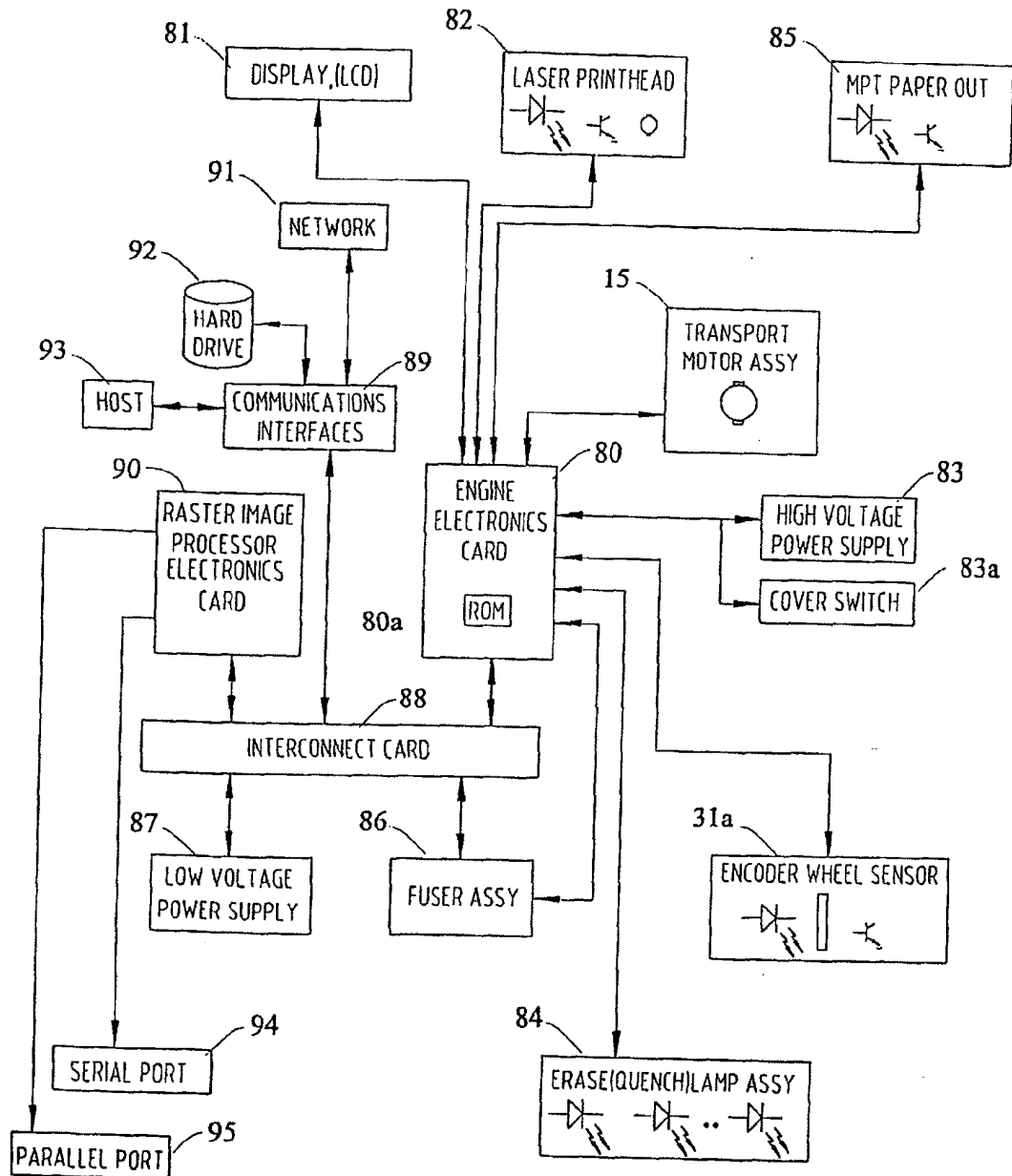




FIG. 8A

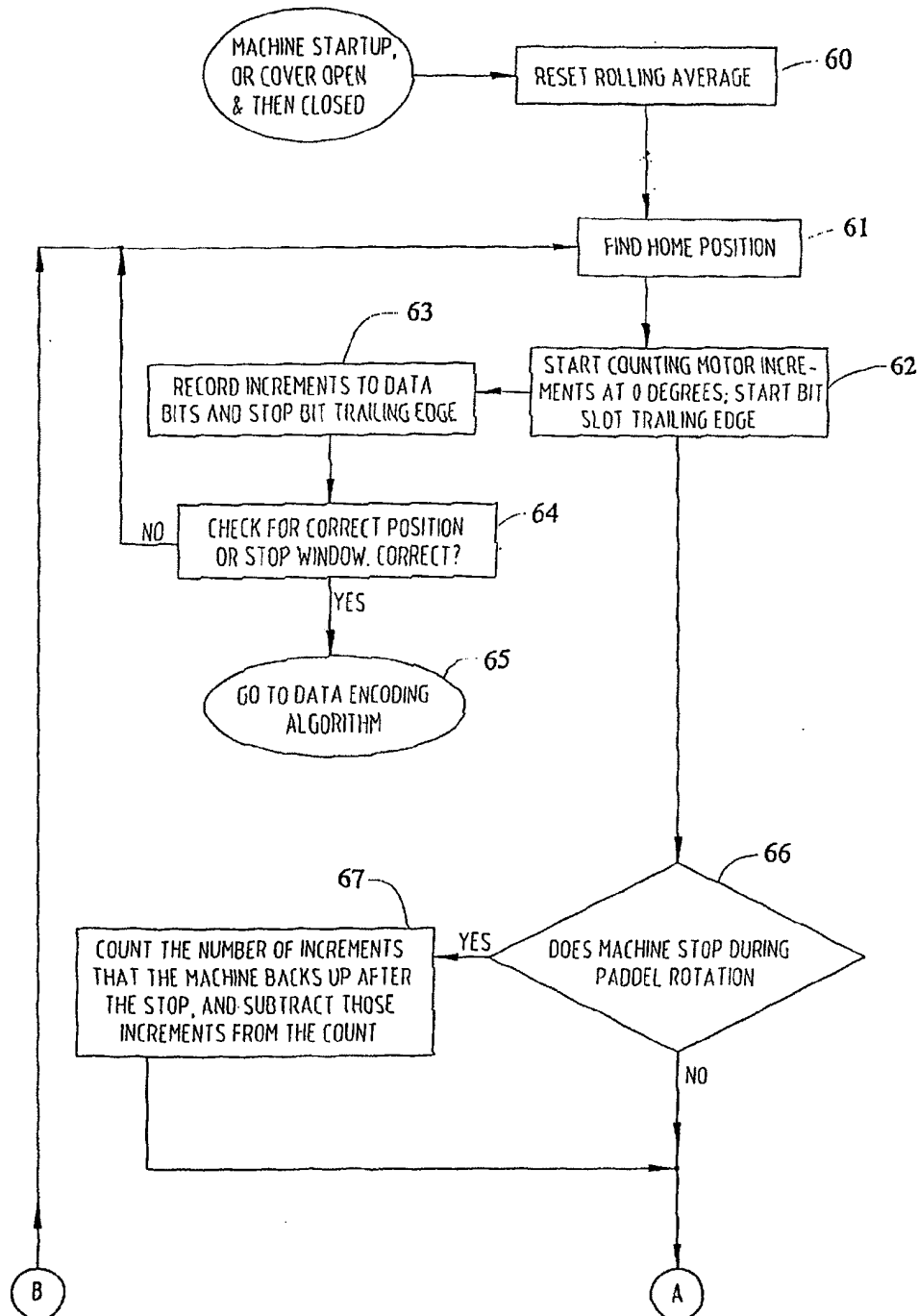
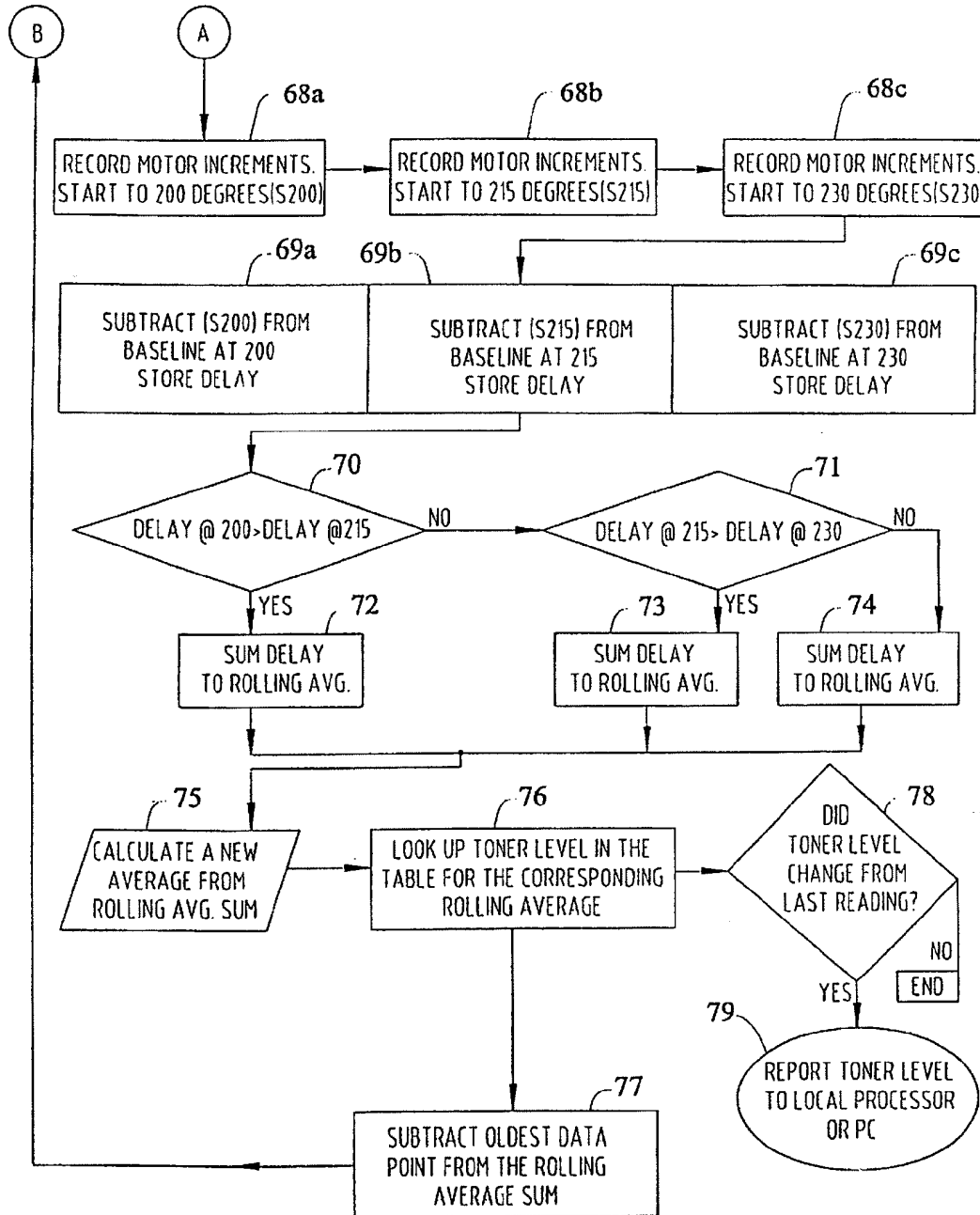


FIG. 8B



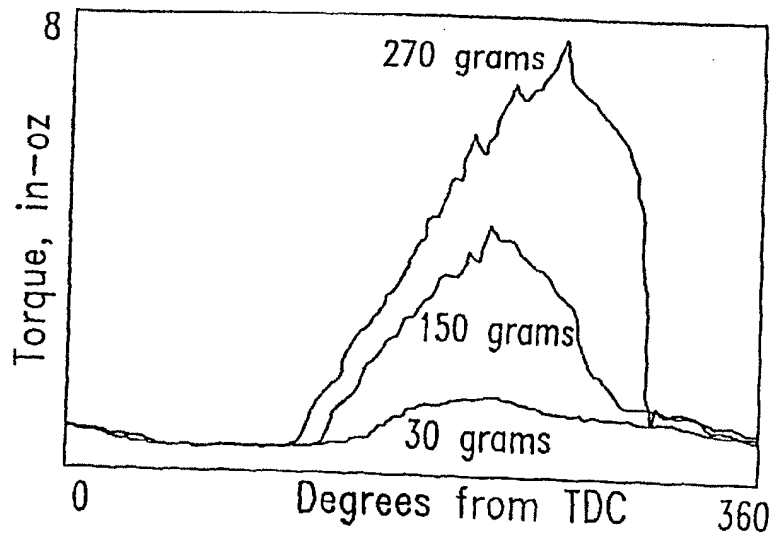


Fig. 9

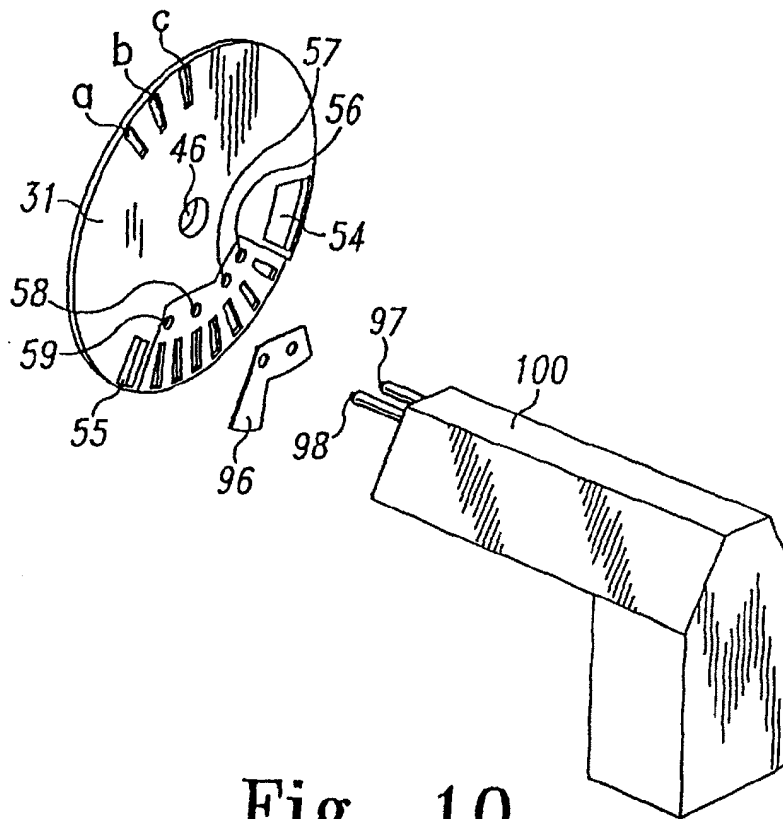


Fig. 10



FIG. 11A

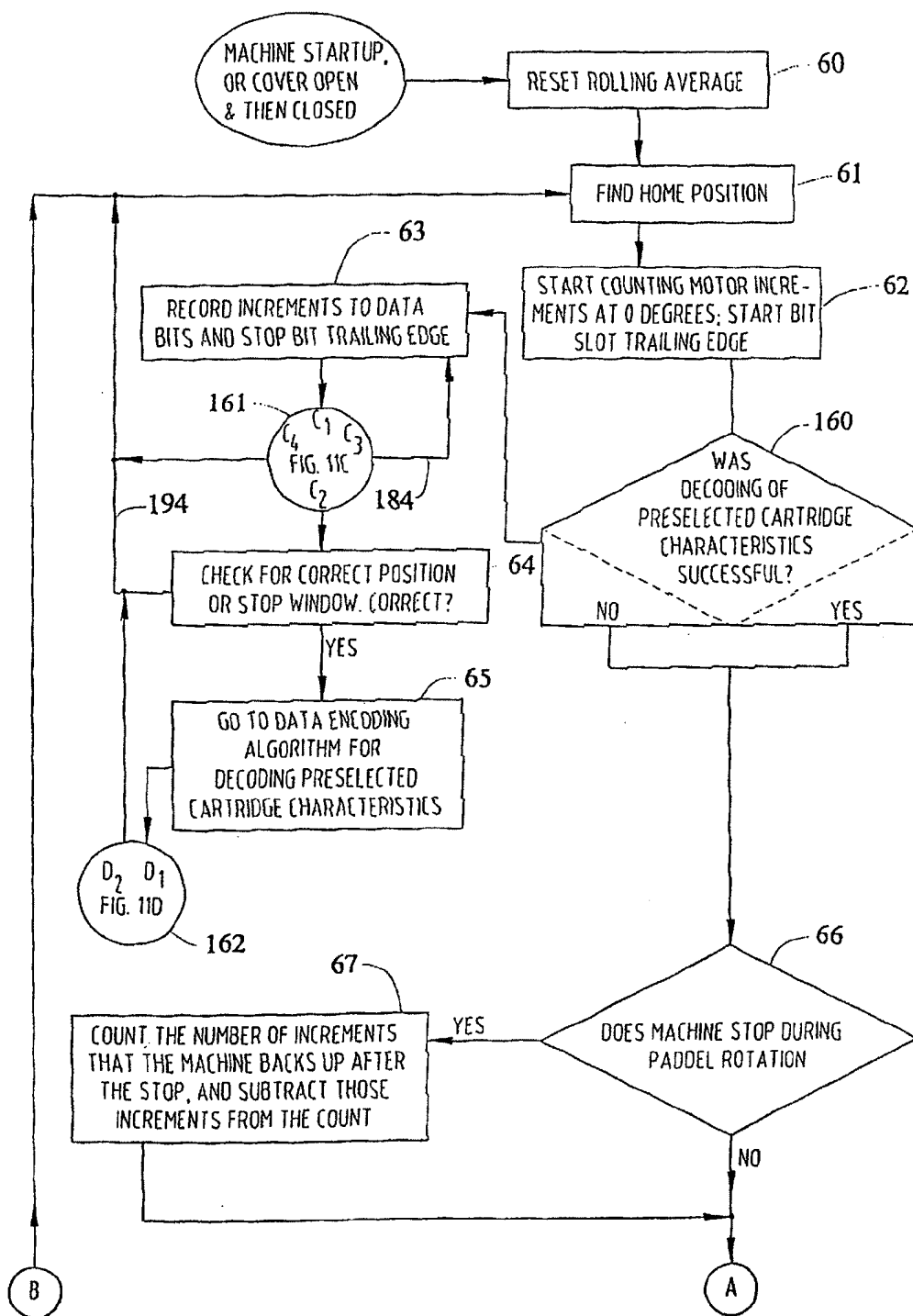


FIG. 11B

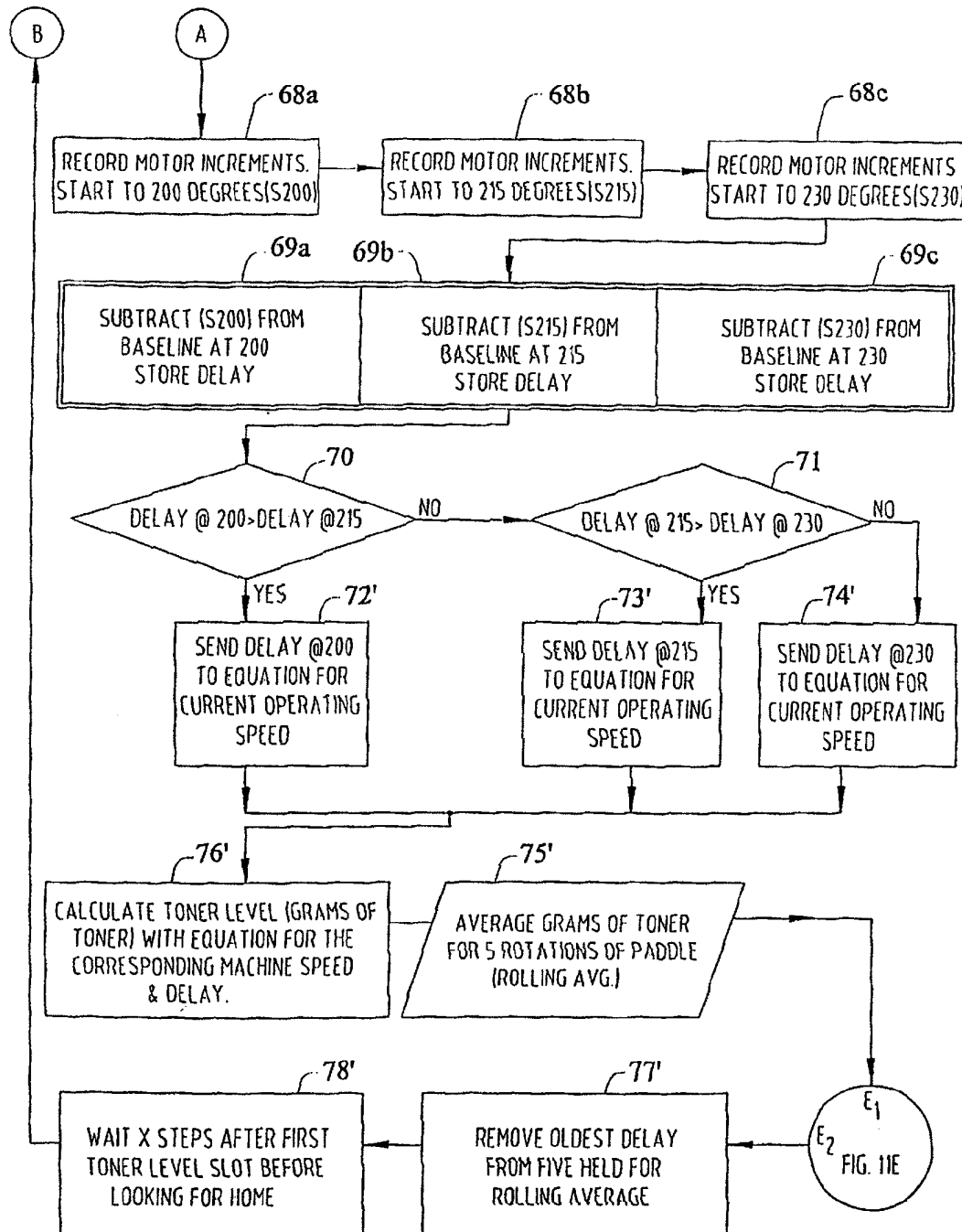


FIG. 11C

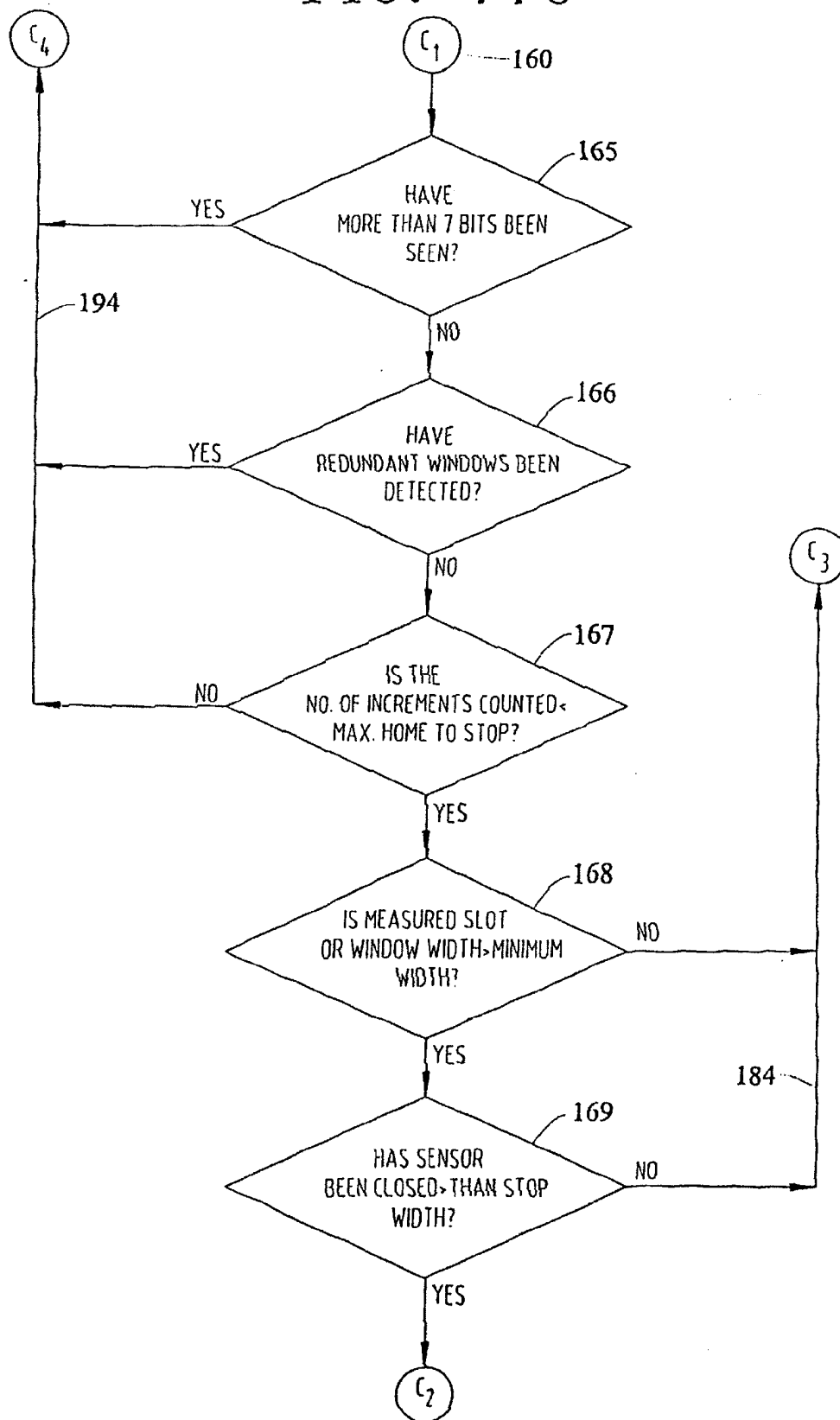


FIG. 11D

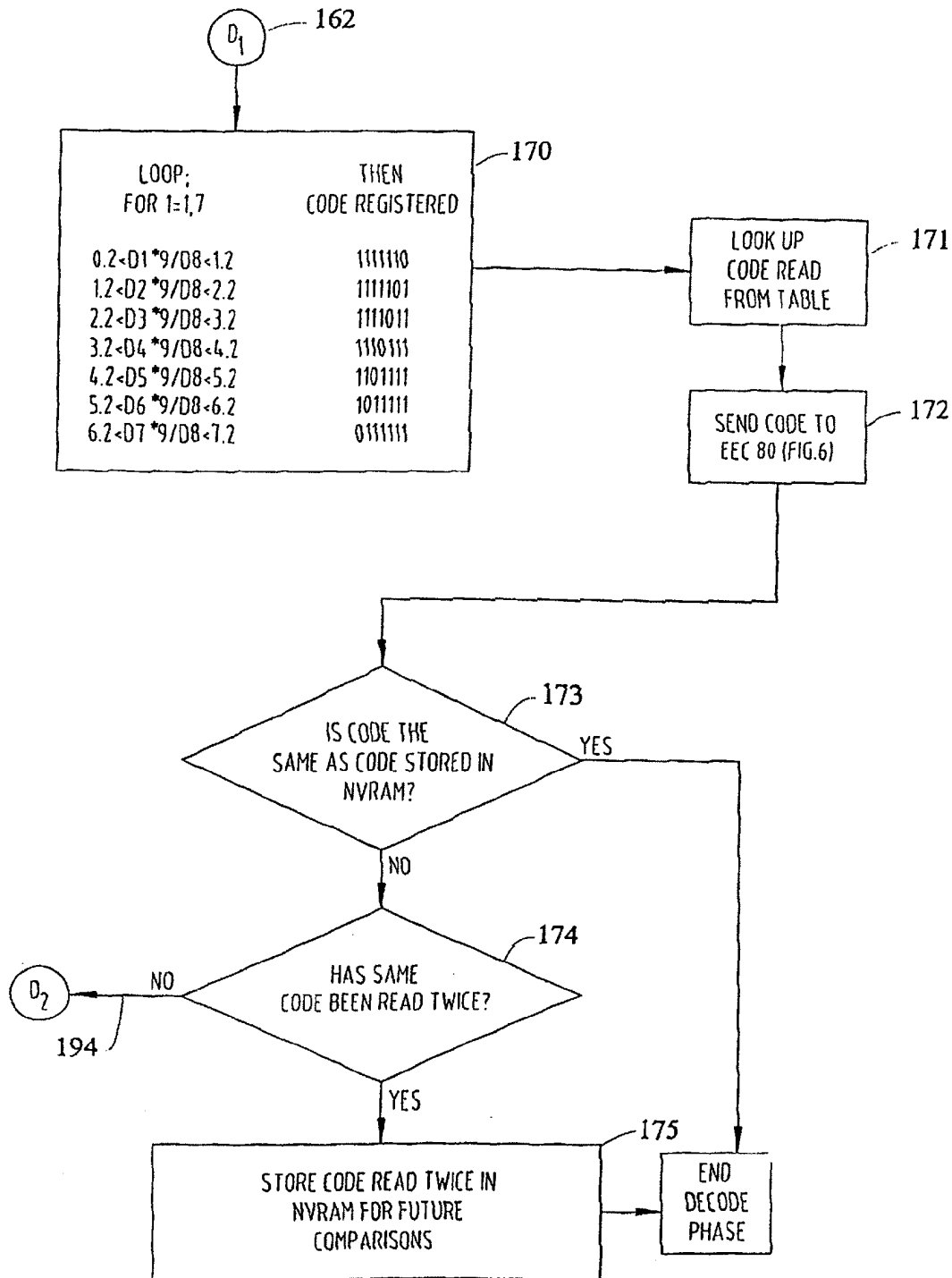


FIG. 11E

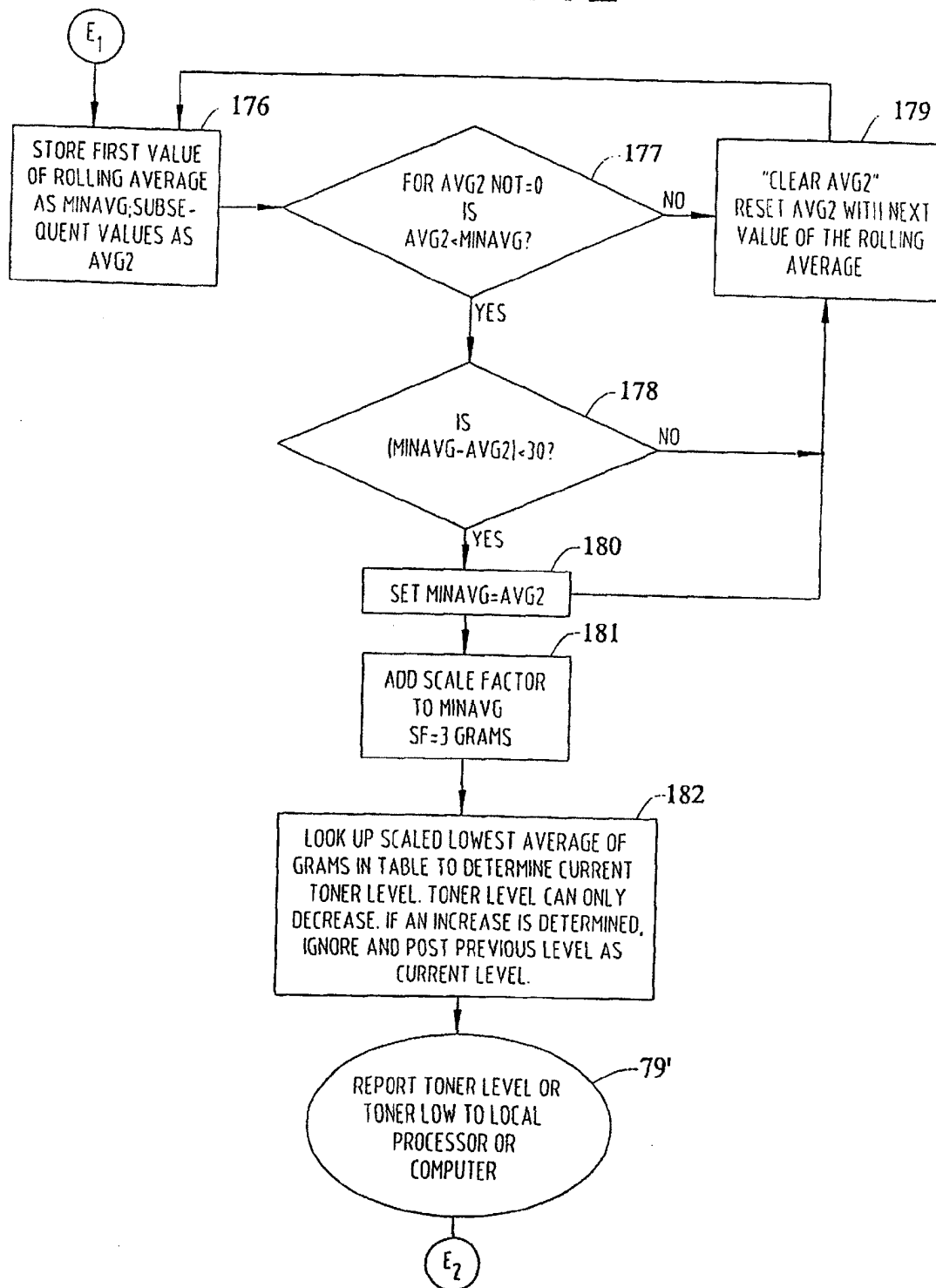


FIG. 12

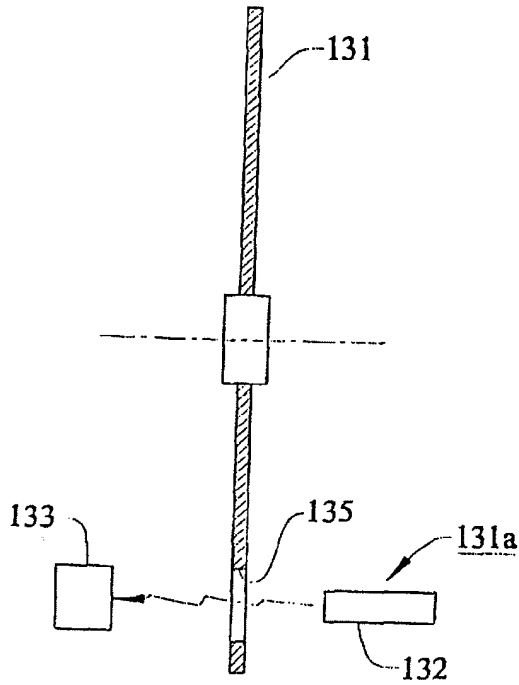


FIG. 13

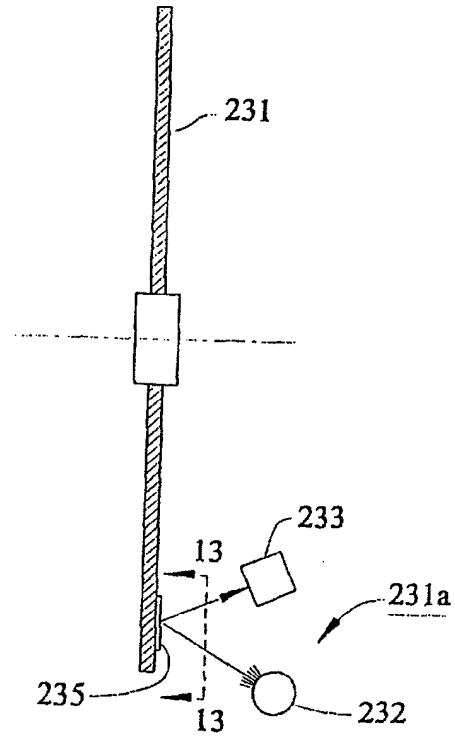
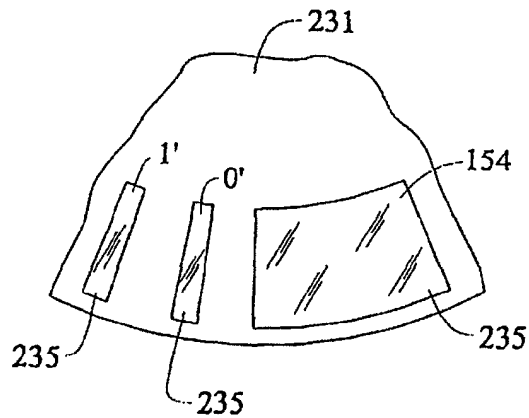
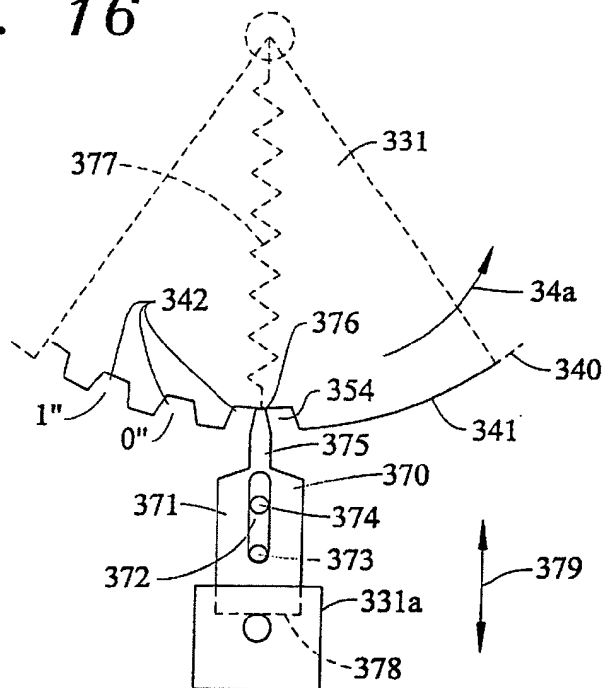


FIG. 14







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# **ENCODED DEVICE HAVING POSITIONED INDICIA FOR USE WITH A TONER CARTRIDGE**

This application is a continuation of U.S. patent application Ser. No. 09/557,096 filed on Apr. 21, 2000, which is a division of U.S. patent application Ser. No. 09/415,620 filed on Oct. 12, 1999, now U.S. Pat. No. 6,169,860, which is a continuation of U.S. patent application Ser. No. 08/975,389 filed on Nov. 20, 1997, now U.S. Pat. No. 6,009,285, which is a continuation of U.S. patent application Ser. No. 08/768,257 filed on Dec. 17, 1996, now U.S. Pat. No. 5,995,772, which is a continuation-in-part of U.S. patent application Ser. No. 08/602,648 filed on Feb. 16, 1996, now U.S. Pat. No. 5,634,169.

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## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

The present invention relates to Electrophotographic (EP) machines and more particularly relates to methods and apparatus associated with replaceable supply cartridges for such machines wherein information concerning the cartridge is provided to the machine to promote correct and efficient operation thereof.

### **2. Description of Related Art**

Many Electrophotographic output device (e.g., laser printers, copiers, fax machines etc.) manufacturers such as Lexmark International, Inc., have traditionally required information about the EP cartridge to be available to the output device such that the control of the machine can be altered to yield the best print quality and longest cartridge life.

The art is replete with devices or entry method to inform the EP machine about specific EP cartridge characteristics. For example, U.S. Pat. No. 5,208,631 issued on May 4, 1993, discloses a technique to identify colorimetric properties of toner contained within a cartridge in a reproduction machine by imbedding in a PROM within the cartridge specific coordinates of a color coordinate system for mapping color data.

In other prior art, for example U.S. Pat. No. 5,289,242 issued on Feb. 22, 1994, there is disclosed a method and system for indicating the type of toner print cartridge which has been loaded into an EP printer. Essentially, this comprises a conductive strip mounted on the cartridge for mating with contacts in the machine when the lid or cover is closed. The sensor is a two position switch which tells the user the type of print cartridge which has been loaded into the printer. While this method is effective, the amount of information that can be provided to the machine is limited.

In still other prior art, such as in U.S. Pat. No. 5,365,312 issued on Nov. 15, 1994 a memory chip containing information about the current fill status or other status data is retained. The depleted status of print medium is supplied by counting consumption empirically. The average of how much toner is required for toning a charge image is multiplied by the number of revolutions of the charge image carrier or by the degree of inking of the characters via an optical sensor. In either method, the count is less than

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accurate and depends upon average ink coverage on the page, or alternatively, the character density which can change dramatically due to font selection. Therefore at best, the consumption count lacks accuracy.

The literature suggests several methods for detecting toner level in a laser printer. Most of these methods detect a low toner condition or whether toner is above or below a fixed level. Few methods or apparatus effectively measure the amount of unused toner remaining. As an example, Lexmark® printers currently employ an optical technique to detect a low toner condition. This method attempts to pass a beam of light through a section of the toner reservoir onto a photo sensor. Toner blocks the beam until its level drops below a preset height.

Another common method measures the effect of toner on a rotating agitator or toner paddle which stirs and moves the toner over a sill to present it to a toner adder roll, then developer roll and ultimately the PC Drum. The paddle's axis of rotation is horizontal. As it proceeds through it's gull 360 degree rotation the paddle enters and exits the toner supply. Between the point where the paddle contacts the toner surface and the point where it exits the toner, the toner resists the motion of the paddle and produces a torque load on the paddle shaft. Low toner is detected by either 1) detecting if the torque load caused by the presence of toner is below a given threshold at a fixed paddle location or 2) detecting if the surface of the toner is below a fixed height.

In either method there is a driving member supplying drive torque to a driven member (the paddle) which experiences a load torque when contacting the toner. Some degree of freedom exists for these two members to rotate independently of each other in a carefully defined manner. For the first method 1) above, with no load applied to the paddle, both members rotate together. However, when loaded the paddle lags the driving member by an angular distance that increases with increasing load. In the second method 2), the unloaded paddle leads the rotation of the driving member, under the force of a spring or gravity. When loaded (i.e., the paddle contacts the surface of the toner), the driving and driven members come back into alignment and rotate together. By measuring the relative rotational displacement of the driving and driven members (a.k.a. phase difference) at an appropriate phase in the paddle's rotation, the presence of toner can be sensed.

In the prior art, this relative displacement is sensed by measuring the phase difference of two disks. The first disk is rigidly attached to a shaft that provides the driving torque for the paddle. The second disk is rigidly attached to the shaft of the paddle and in proximity to the first disk. Usually both disks have matching notches or slots in them. The alignment of the slots or notches, that is how much they overlap, indicates the phase relationship of the disks and therefore the phase of the driving and driven members.

Various art showing the above methods and variations are set forth below.

In U.S. Pat. No. 4,003,258, issued on Jan. 18, 1977 to Ricoh Co., is disclosed the use of two disks to measure toner paddle location relative to the paddle drive shaft. When the paddle reaches the top of its rotation the coupling between paddle and drive shaft allows the paddle to free fall under the force of gravity until it comes to rest on the toner surface or at the bottom of its rotation. Toner low is detected if the angle through which the paddle falls is greater than a fixed amount (close to 180 degrees). A spring connects the two disks, but the spring is not used for toner detection. It is used to fling toner from the toner reservoir to the developer.

In U.S. Pat. No. 5,216,462, issued to Oki Electric Co., Jun. 1, 1993, is described a system where a spring connects two disks so that the phase separation of the disks indicates torque load on the paddle. An instability is noted in this type of system. If further describes a system similar to the Patent above where the paddle free falls from its top dead position to the surface of the toner. The position of the paddle is sensed through magnetic coupling to a lever outside of the toner reservoir. This lever activates an optical switch when the paddle is near the bottom of its rotation. A low toner indication results when the time taken for the paddle to fall from the top dead center to the bottom of the reservoir, as sensed by the optical switch, is less than a given value.

In U.S. Pat. No. 4,592,642, issued on Jun. 3, 1986 to Minolta Camera Co., is described a system that does not use the paddle directly to measure toner, but instead uses the motion of the paddle to lift a "float" above the surface of the toner and drop it back down on top of the toner surface. A switch is activated by the "float" when in the low toner position. If the "float" spends a substantial amount of time in the low toner position the device signals low toner. Although the patent implies that the amount of toner in the reservoir can be measured, the description indicates that it behaves in a very non-linear, almost binary way to merely detect a toner low state.

U.S. Pat. No. 4,989,754, issued on Feb. 5, 1991 to Xerox Corp., differs from the others in that there is no internal paddle to agitate or deliver toner. Instead the whole toner reservoir rotates about a horizontal axis. As the toner inside rotates with the reservoir it drags a rotatable lever along with it. When the toner level becomes low, the lever, no longer displaced from its home position by the movement of the toner, returns to its home position under the force of gravity. From this position the lever activates a switch to indicate low toner.

In still another U.S. Pat. No. 4,711,561, issued on Dec. 8, 1987 to Rank Xerox Limited this patent describes a means of detecting when a waste toner tank is full. It employs a float that gets pushed upward by waste toner fed into the tank from the bottom. The float activates a switch when it reaches the top of the tank.

U.S. Pat. No. 5,036,363, issued on Jul. 30, 1991 to Fujitsu Limited, describes the use of a commercially available vibration sensor to detect the presence of toner at a fixed level. The patent describes a simple timing method for ignoring the effect of the sensor cleaning mechanism of the sensor output.

U.S. Pat. No. 5,349,377, issued on Sep. 20, 1994 to Xerox Corp., discloses an algorithm for calculating toner usage and hence amount of toner remaining in the reservoir by counting black pixels and weighting them for toner usage based on pixels per unit area in the pixel's neighborhood. This is unlike the inventive method and apparatus disclosed hereinafter.

### SUMMARY OF THE INVENTION

The present invention is related to apparatus and method for representing cartridge characteristic information by an encoded device, and for reading such information from the encoded device.

One aspect of the invention is directed to a toner cartridge including a sump for carrying a supply of toner. An agitator is rotatably mounted in the sump, and the agitator has a first end and a second end. An encoded wheel is coupled to the first end of the agitator. The encoder wheel is structured and adapted to include a first preselected cartridge characteristic

indicia having a first extent, a stop indicia having a second extent larger than the first extent and a start indicia having a third extent larger than the second extent. In a most preferred embodiment, each indicia is in the form of a slot.

Another aspect of the invention is directed to a toner cartridge including a sump for carrying a supply of toner. An agitator is rotatably mounted in the sump. The agitator has a first end and a second end. An encoder wheel is coupled to the first end of the agitator. The encoded wheel includes preprogrammed indicia positioned at locations defined in relation to a clock face. The preprogrammed indicia include a start indicia positioned between about a 5:00 o'clock position and a 6:00 o'clock position, a stop indicia positioned at about a 9:00 o'clock position, at least one preselected cartridge characteristic indicia positioned between the start indicia and the stop indicia, and at least one measurement indicia located between about 200 degrees and about 230 degrees in a clockwise direction from the 6:00 o'clock position.

Other features and advantages of the invention may be determined from the drawings and detailed description of the invention that follows.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevational view illustrating the paper path in a typical electrophotographic machine, in the illustrated instance a printer, and showing a replacement supply EP cartridge, constructed in accordance with the present invention, and the manner of insertion thereof into the machine;

FIG. 2 is a fragmentary, enlarged, simplified, side elevational view of the cartridge illustrated in FIG. 1, and removed from the machine of FIG. 1;

FIG. 3 is a fragmentary perspective view of the interior driven parts of the EP cartridge illustrated in FIGS. 1 and 2, including the encoder wheel and its relative position with regard to the drive mechanism for the cartridge interior driven parts;

FIG. 4 is an enlarged fragmentary perspective view of the agitator/paddle drive for the toner sump, and illustrating a portion of the torque sensitive coupling between the drive gear and the driven shaft for the agitator/paddle;

FIG. 5A is a fragmentary view similar to FIG. 4, except illustrating another portion of the torque sensitive coupling for coupling the driven shaft for the agitator/paddle, through the coupling to the drive gear, and FIG. 5B depicts the reverse side of one-half of the torque sensitive coupling, and that portion which connects to the agitator/paddle shaft;

FIG. 6 is a simplified electrical diagram for the machine of FIG. 1, and illustrating the principal parts of the electrical circuit;

FIG. 7 is an enlarged side elevational view of the encoder wheel employed in accordance with the present invention, and viewed from the same side as shown in FIG. 2, and from the opposite side as shown in FIG. 3;

FIG. 8A is a first portion of a flow chart illustrating the code necessary for machine start up, and the reading of information coded on the encoder wheel;

FIG. 8B is a second portion of the flow chart of FIG. 8A illustrating the measurement of toner level in the toner sump;

FIG. 9 is a graphical display of the torque curves for three different toner levels within the sump, and at various positions of the toner paddle relative to top dead center or the home position of the encoder wheel;

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FIG. 10 is a perspective view of an encoder wheel with novel apparatus for blocking off selected slots in the encoder wheel for coding the wheel with EP cartridge information.

FIGS. 11A–11E represent in flow chart form an alternative method for machine start up, the reading of information coded on the encoder wheel and the measurement of toner level in the toner sump;

FIG. 12 is a sectional view of an encoder wheel and a schematic representation of an alternative Hall effect reader/sensor of the invention;

FIG. 13 is a sectional view of an encode wheel and a schematic representation of an alternative reflective reader/sensor of the invention;

FIG. 14 is a fragmentary side elevational view of a portion of the encode wheel of FIG. 12 and taken along line 13–13 of FIG. 12;

FIG. 15 is a fragmentary side elevational view of an encoder wheel with a cam surface implementation and a cam follower reader/sensor mechanism; and

FIG. 16 is a fragmentary side elevational view of an encoder wheel with a cam surface implementation and an alternative cam follower reader/sensor mechanism.

#### DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENTS

Turning now to the drawings, and particularly FIG. 1 thereof, a laser printer 10 constructed in accordance with the present invention, is illustrated therein. FIG. 1 shows a schematic side view of the printer 10, illustrating the print receiving media path 11 and including a replacement supply electrophotographic (EP) cartridge 30, constructed in accordance with the present invention. As illustrated, the machine 10 includes a casing or housing 10a which supports at least one media supply tray 12, which by way of a picker arm 13, feeds cut sheets of print receiving media 12a (e.g., paper) into the media path 11, past the print engine which forms in the present instance part of the cartridge 30, and through the machine 10. A transport motor drive assembly 15 (FIG. 3) affords the driving action for feeding the media through and between the nips of pinch roller pairs 16–23 into a media receiving output tray 26.

In accordance with the invention, and referring now to FIGS. 1 & 2, the cartridge 30 includes an encoder wheel 31 adapted for coaction, when the cartridge 30 is nested in its home position within the machine 10, with an encoder wheel sensor or reader 31a for conveying or transmitting to the machine 10 information concerning cartridge characteristics including continuing data (while the machine is running) concerning the amount of toner remaining within the cartridge and/or preselected cartridge characteristics, such as for example, cartridge type or size, toner capacity, toner type, photoconductive drum type, etc. To this end, the encoder wheel 31 is mounted, in the illustrated instance on one end 32a of a shaft 32, which shaft is coaxially mounted for rotation within a cylindrical toner supply pump 33. Mounted on the shaft 32 for synchronous rotation with the encoder wheel 31, extending radially from the shaft 32 and axially along the sump 33 is a toner agitator or paddle 34. The toner 35 level for a cartridge (depending upon capacity) is generally as shown extending from approximately the 9:00 position and then counter clockwise to the 3:00 position. As the paddle 34 rotates counter clockwise in the direction of the arrow 34a, toner tends to be moved over the sill 33a of the sump 33. (The paddle 34 is conventionally provided with large openings 34b, FIG. 3, to provide lower resistance thereto as it passes through the toner 35.) As best

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shown in FIGS. 2 & 3, the toner that is moved over the sill 33a, is presented to a toner adder roll 36, which interacts in a known manner with a developer roll 37 and then a photo conductive (PC) drum 38 which is in the media path 11 for applying text and graphical information to the print receiving media 12a presented thereto in the media path 11.

Referring now to FIG. 3, the motor transport assembly 15 includes a drive motor 15a, which is coupled through suitable gearing and drive take-offs 15b to provide multiple and differing drive rotations to, for example, the PC drum 38 and a drive train 40 for the developer roll 37, the toner adder roll 36 and through a variable torque arrangement, to one end 32b of the shaft 32. The drive motor 15a may be of any convenient type, e.g., a stepping motor or in the preferred embodiment a brushless DC motor. While any of several types of motors may be employed for the drive, including stepping motors, a brushless DC motor is ideal because of the availability of either hall effect or frequency generated feedback pulses which present measurable and finite increments of movement or the motor shaft. The feedback accounts for a predetermined distance measurement, which will be referred to as an increment rather than a 'step' so as not to limit the drive to a stepping motor.

The drive train 40, which in the present instance forms part of the cartridge 30, includes driven gear 40a, which is directly coupled to the developer roll 37, and through an idler gear 40b is coupled to the toner adder roll 36 by gear 40c. Gear 40c in turn through suitable reduction gears 40d and 40e drives final drive gear 41. In a manner more fully explained below with reference to FIGS. 5 & 6 the drive gear 41 is coupled to the end 32b of shaft 32 through a variable torque sensitive coupling.

In FIG. 3, the gear 41 is shown as including an attached web or flange 42 connected to a collar 43 which acts as a bearing permitting, absent restraint, free movement of the gear 41 and its web 42 about the end 32b of the shaft 32. Referring now to FIG. 4, the driving half of the variable torque sensitive coupling is mounted on the web 42 of the gear 41. To this end, the driving half of the coupling includes a coiled torsion spring 44, one leg 44a of which is secured to the web 42 of the gear 41, the other leg 44b of which is free standing.

Turning now to FIG. 5A, the other half (driven half) of the coupling is illustrated therein. To this end, an arbor 45 having a keyed central opening 46 dimensioned for receiving the keyed (flat) shaft end 32b of the shaft 32, is depicted therein. For ease of understanding, an inset drawing is provided wherein the reverse side of the arbor 45 is shown. The arbor 45 includes radially extending ear portions 47a, 47b, the extended terminal ends of which overlay the flange 48 associated with the web 42 of the gear 41. The rear face or back surface 45a of the arbor 45 (see FIG. 5B) confronting the web 42, includes depending, reinforcing leg portions 49a, 49b. A collar 46a abuts the web 42 or the gear 41 and maintains the remaining portion of the arbor 45 spaced from the web 42 of the gear 41. Also attached to the rear of the back surface 45a of the arbor 45 is a clip 50 which grasps the free standing leg 44b of the spring 44.

Thus one end 44a (FIG. 4) of the spring 44 is connected to the web 42 of the gear 41, while the other end 44b of the spring 44 is connected to the arbor 45 which is in turn keyed to the shaft 32 mounted for rotation in and through the sump 33 of the cartridge 30. Therefore the gear 41 is connected to the shaft 32 through the spring 44 and the arbor 45. As the gear 41 rotates, the end 44b of the spring presses against the catch 50 in the arbor 45 which tends to rotate causing the



paddle 34 on the shaft 32 to rotate. When the paddle first engages the toner 35 in the sump 33, the added resistance causes an increase in torsion and the spring 44 tends to wind up thereby causing the encoder wheel 31 to lag the rotational position of the gear 41. Stops 51 and 52 mounted on the flange 48 prevent over winding or excessive stressing of the spring 44. In instances where the sump 33 is at the fill design level of toner 35, the ears 47a, 47b engage the stops 52 and 51 respectively. The spring 44 therefore allows the paddle shaft 32 to lag relative to the gear 41 and the drive train 40 because of the resistance encountered against the toner 35 as the paddle 34 attempts to move through the sump 33. The more resistance encountered because of toner against the paddle 34, the greater the lag. As shall be described in more detail hereinafter, the difference in distance traveled by the gear 41 (really the motor 15a) and the encoder wheel 31, as the paddle 34 traverses the sump 33 counter clockwise from the 9:00 position (see FIG. 2), to about the 5:00 position, is a measure of how much toner 35 remains in the sump 33, and therefore how many pages may yet be printed by the EP machine or printer 10 before the cartridge 30 is low on toner. This measurement technique will be explained more fully with regard to finding the home position of the encoder wheel 31 and reading the wheel.

Turning now to FIG. 6 which is a simplified electrical diagram for the machine 10, illustrating the principal parts of the electrical thereof, the machine employs two processor (micro-processor) carrying boards 80 and 90, respectively labeled "Engine Electronics Card" and "Raster Image Processor Electronics Card" (hereinafter called EEC and RIP respectively). As is conventional with processors, they include memory, I/O and other accountments associated with small system computers on a board. The EEC 80, as shown in FIG. 6, controls machine functions, generally through programs contained in the ROM 80a on the card and in conjunction with its on-board processor. For example, on the machine, the laser printhead 82; the motor transport assembly 15; the high voltage power supply 83 and a cover switch 83a which indicates a change of state to the EEC 80 when the cover is opened; the Encoder Wheel Sensor 31a which reads the code on the encoder wheel 31 informing the EEC 80 needed cartridge information and giving continuing data concerning the toner supply in the sump 33 of the EP cartridge 30; a display 81 which indicates various machine conditions to the operator, under control of the RIP when the machine is operating but capable of being controlled by the EEC during manufacturing, the display being useful for displaying manufacturing test conditions even when the RIP is not installed. Other functions such as the Erase or quench lamp assembly 84 and the MPT paper-out functions are illustrated as being controlled by the EEC 80. Other shared functions, e.g., the Fuser Assembly 86 and the Low Voltage Power Supply 87 are provided through an interconnect card 88 (which includes bussing and power lines) which permits communication between the RIP 90 and EEC 80, and other peripherals. The Interconnect card 88 may be connected to other peripherals through a communications interface 89 which is available for connection to a network 91, non-volatile memory 92 (e.g., Hard drive), and of course connection to a host 93, e.g., a computer such as a personal computer and the like.

The RIP primarily functions to receive the information to be printed from the network or host and converts the same to a bit map and the like for printing. Although the serial port 94 and the parallel port 95 are illustrated as being separable from the RIP card 90, conventionally they may be positioned on or as part of the card.

Prior to discussing, via the programming flow chart, the operation of the machine in accordance with the invention, the structure of the novel encoder wheel 31 should be described. To this end, and referring now to FIG. 7, the encoder wheel 31 is preferably disk shaped and comprises a keyed central opening 31b for receipt by like shaped end 32a of the shaft 32. The wheel includes several slots or windows therein which are positioned preferably with respect to a start datum line labeled D0, for purposes of identification. From a "clock face" view, D0 resides at 6:00, along the trailing edge of a start/home window 54 of the wheel 31. (Note the direction of rotation arrow 34a.) The paddle 34 is schematically shown positioned at top-dead-center (TDC) with respect to the wheel 31 (and thus the sump 33). The position of the encoder wheel sensor 31a, although stationary and attached to the machine, is assumed, for discussion purposes, aligned with D0 in the drawing and positioned substantially as shown schematically in FIG. 1.

Because the paddle 34 is generally out of contact with the toner in the sump, from the 3:00 position to the 9:00 position (counter clockwise rotation as shown by arrow 34a), and the shaft velocity may be assumed to be fairly uniform when the paddle moves from at least the 12:00 (TDC) positioned to the 9:00 position, information concerning the cartridge 30 is preferably encoded on the wheel between 6:00 and approximately the 9:00 position. To this end, the wheel 31 is provided with radially extending, equally spaced apart, slots or windows 0-6, the trailing edges of which are located with respect to D0 and labeled D1-D7 respectively. Each of the slots 0-6 represents an information or data bit position which may be selectively covered as by one or more decals 96, in a manner to be more fully explained hereinafter with reference to FIG. 10. Suffice at this point that a plurality of apertures 56-59 are located along an arc with the same radius but adjacent the data slots or windows 0-6. Note that the spacing between apertures 56 and 57 is less than the spacing between apertures 58 and 59.

The coded data represented by combinations of covered, not-covered slots 0-6 indicate to the EEC 80 necessary information as to the EP cartridge initial capacity, toner type, qualified or unqualified as an OEM type cartridge, or such other information that is either desirable or necessary for correct machine operation. Adjacent slot 6 is a stop window 55 which has a width equal to the distance between the trailing edges of adjacent slots or windows, e.g., D1=(D2-D1, =D3-D2 etc.)=the width of window 55. Note that the stop window 5 is also spaced from the trailing edge of slot 6 a distance equal to the stop window width 55. That is, the distance D8-D7=twice the window 55 width while the window width of window 55 is greater than the width of the slots 0-6.

Adjacent slot 0, from approximately the 5:00 to the 6:00 position is a start/home window 54. The start/home window 54 is deliberately made larger than any other window width. Because of this width difference, it is easier to determine the wheel position and the start of the data bit presentation to the encoder wheel sensor 31a. The reason for this will be better understood when discussing the programming flow charts of FIGS. 8A and 8B.

In order to provide information to the EEC 80 as to the lag of the encoder wheel 31 relative to the transport motor 15a position (counted increments), three additional slots or windows "a", "b" and "c" are provided at D9, D10 and D11 respectively. The trailing edge of slot "a" (angular distance D9) is 200° from D0; the trailing edge of slot "b" (angular distance D10) is 215° from D0 and the trailing edge of slot "c" (angular distance D11) is 230° from D0. From FIG. 7 it

may be seen that when the slot "a" passes the sensor 31a at D0, the paddle 34 will have already passed bottom dead center (6:00 position) by 20° (200°–180°); window or slot "b" by 35° (215°–180°), and slot "c" by 50° (230°–180°). The significance of the placement of the slots "a", "b" and "c" will be more fully explained, hereinafter, with respect to FIG. 9.

Referring now to FIGS. 8A and 8B which shows respectively a programming and functional flow chart illustrating the code necessary for machine start up, and the reading of information coded on the encoder wheel, including the measurement of toner 35 level in the toner sump 33. At the outset, it is well that it be understood that there is no reliance on or measurement of the speed of the machine, as it differs depending upon the operation (i.e., resolution; toner type; color etc.) even though a different table may be required for look up under gross or extreme speed change conditions. Accordingly, rather than store in the ROM 80a a norm for each of several speeds to obtain different resolutions to which the actual could be compared to determine the amount of toner left, what is read instead is the angular 'distance' traversed by the encoder wheel 31 referenced to the angular distance traveled by the motor, and then comparing the difference between the two angular measurements to a norm or base-line to determine the amount of toner 35 left in the

cartridge data and/or amount of toner 35 remaining in the cartridge 30. Therefore a new 'rolling average' is created in the EEC 80. With regard to host notification, however, the old data would be reported because the great majority of time when the machine is started up or the cover is closed once opened, a new cartridge will not have been installed, and reliance may usually be placed upon the previous information.

The next logical step at 61 is to 'Find the Home position' of the encoder wheel 31. In order for either the toner level or cartridge characteristics algorithms to operate properly, the "home position" of the wheel 31 must first be found. Necessarily, the EEC 80, through sensor 31a must see the start of a window before it begins determining the home or start position of the wheel, since the engine could be stopped in, for instance, the stop window 55 position and due to backlash in the system, the motor may move enough distance before the encoder wheel actually moves that the measured "total window width" could appear to be the start/home window 54. Below is set forth in pseudo code the portion of the program for finding the start/home window 54. As previously discussed, the start/home window 54 is wider than the stop window 55 or for that matter, any other slot or window on the encoder wheel 31.

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'Find the home window first
This loop runs on motor "increments"
HomeFound = False
while ( ! HomeFound)
If (found the start of a Window) Then
    Window Width = 0
    While (not at the end of Window) {increment WindowWidth}
        If (WindowWidth > MINIMUM_HOME_WIDTH
        AND WindowWidth < MAXIMUM_HOME_WIDTH) Then
            HomeFound = True
    End if
End While

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sump 33. By observation, it can be seen that the distance that the encoder wheel travels between start or home (D0) and "a", "b", "c" is always the same. So what is being measured is the distance the motor has to travel before slot "a" is sensed, slot "b" is sensed and slot "c" is sensed, and then taking the difference as being the measured lag. In essence, and perhaps an easier way for the reader to understand what is being measured, is that the angular displacement of the paddle 34 is being measured with respect to the angular displacement of the gear 41 (gear train 40 as part of transport motor assembly 15). As discussed below, the greatest number (lag number) indicates the paddle position which gives the highest torque (the most resistance). This number indicates which look up table in ROM should be employed and gives a measure of how much toner 35 is left in the sump 33 of the cartridge 30.

Referring first to FIG. 8A, after machine 10 start up or the cover has been operated and later closed, the Rolling Average is reset, as shown in logic block 60. Simply stated, 'n' (e.g., 5 or 6) sample measurements are examined and the average of them is stored and the code on the encoder wheel 31 of the cartridge 30 is read, compared to what was there before, and then stored. The reason for doing this is that if a user replaces an EP cartridge since the last power on or machine 10 startup, there may be a different toner type, toner level etc. in the new sump. Accordingly, so as not to rely on the old data, new data is secured which includes new

In the above algorithm, 'HomeFound' is set false and a loop is run until the window or slot width meets the conditions of greater than minimum but less than maximum, then 'HomeFound' will be set true and the loop is ended. So the algorithm in essence is articulating; see the window; compare the window with predetermined minimum and maximum widths, for identification; and then indicate that the 'home window' 54 has been found when those conditions are met.

To ensure that the algorithm found home properly, after it identifies the stop window 55, it checks to ensure that the position of the stop window 55 is within reason with respect to the start/home window 54 and of course that the window width is acceptable. This occurs in logic blocks or steps 62, 63 and 64 in FIG. 8A. If this condition is not met, then the configuration information should be taken again. If this check passes, then there is no need to continue to look at the configuration information until a cover closed or power on cycle occurs. This guards against the potential conditions wherein the engine misidentifies the start/home window 54 and thus mis-characterizes the cartridge 30.

Prior to discussing the pseudo-code for 'Reading the Wheel', it may be helpful to recall that a portion of the encoder wheel's 31 revolution is close enough to constant velocity to allow that section to be used and read almost as a "windowed bar code". With reference to FIG. 7, that is the section of the wheel 31 from the trailing edge of the



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start/home window 54 to the trailing edge of the stop window 55 including the slots or windows 0-6. This is preferably in the section of the encoder wheel 31 in which the paddle 34 is not impinging upon or in the toner 35 in the sump 33. Passage of this section over the optical sensor 31a creates a serial bit system which is decoded to gather read-only information about the cartridge. The information contained in this section may comprise information that is essential to the operation of the machine with that particular EP cartridge or "nice to know" information. The information may be divided, for example into two or more different classifications. One may be cartridge 'build' specific, i.e., information which indicates cartridge size, toner capacity,

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edge of each window 0-6 from the trailing edge of the window 54. This acquisition continues until the engine detects the stop window 55 (which is designed to have a greater circumferential width than the data windows 0-6 but less than the start/home window 54). Using a few integer multiplications, the state of each bit in the byte read is set using the recorded distance of each window 0-6 from the trailing edge of the home window 54.

The portion of the program for reading the encoder wheel, in pseudo-code, is as follows:

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'Find Home' (see above)
'Gather distances for all of the data window
  'This loop runs on motor "increments"
  Finished = False
  WindowNumber = 0
  CumulativeCount = 0
  while (!Finished)
    CumulativeCount = CumulativeCount + 1
  If (the start of a window is found) Then
    WindowWidth = 0
    While (not at the end of Window)
      increment WindowWidth
      increment CumulativeCount
    End While
    If (WindowWidth > Minimum Stop window Width
      AND WindowWidth < Maximum Stop Window Width
      AND CumulativeCount > Minimum Stop Position
      AND CumulativeCount < Maximum Stop Position)Then
      'we must ensure that the stop window is really what we found
      Finished = True
      StopDistanceFromHome = CumulativeCount
    Else
      DistanceFromHome(WindowNumber)=CumulativeCount
      WindowNumber = WindowNumber + 1
      End If check for stop window
    End If check for start of window
  End While
'Now translate measurements into physical bits
Data Value = 0
'First divide the number of samples taken by 9
BitDistance = StopDistanceFromHome/9
For 1 = 0 To WindowNumber - 1
  BitNumber = DistanceFromHome(I)/BitDistance
  'What is being determined is the bit number corresponding to the
  'measurement by rounding up DistanceFromHome(I)/BitDistance.
  If ((DistanceFromHome(I) - (BitDistance * BitNumber)) * 2 > BitDistance) Then
    BitNumber = BitNumber + 1
  End If
  DataValue = DataValue + 1 (SHIFTLLEFT) BitNumber - 1
Next' Window number
DataValue = -DataValue ' invert result since windows are logic 0's

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toner type, photo conductor (PC) drum type, and is personalized when the cartridge is built, the other which may allow for a number of unique "cartridge classes" which may be personalized before cartridge shipment, depending, for example, upon the OEM destination. The latter classification may, for example inhibit the use of cartridges from vendors where it is felt that the cartridge will give inferior print, may have some safety concern, or damage the machine in some way. Alternatively, if the machine is supplied as an OEM unit to a vendor for his own logo, the cartridges may be coded so that his logo cartridge is that which is acceptable to the machine. The selective coding by blocking of the windows may be performed via a stick-on-decal operation which will be more fully explained with reference to FIG. 10.

The 'Find Home' code determines the start/home window 54 and measures the distance corresponding to the trailing

The program depicted above in pseudo code for reading the wheel is quite straight forward. Thus in logic step 63, (FIG. 8A) where the motor increments are recorded for each data bit, and stop bit trailing edge, as was discussed with regard to FIG. 7 that the distances D1-D7 between the trailing edges of windows or slots 0 through 6, are equally spaced, (i.e., D7-D6=some constant "K", D5-D4=constant "K" etc.) The trailing edge of the stop window 55 is also a distance of twice "K" from the trailing edge of slot 6. While the distance from the trailing edge of stop window 55 to its leading edge (i.e., the window 55 width) is equal to one 'bit' distance or "K" from the leading edge, this width may be any convenient distance as long as its width is >than the width of the slots 0-6 and <the width of the start/home window 54. Thus the line of pseudo code above 'First divide the number of samples taken by 9' (from the trailing edge of the

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start/home window of slot 54) means that there are 7 bits from D1 through D7, plus two more through D8, and therefore '9' gives the spacing "K" between the windows (trailing edge of the start/home window or slot 54 to the trailing edge of the stop window 55) which may be compared to what this distance is supposed to be, and in that manner insure that the bit windows 0-6 and stop window 55 have been found. If the stop window 5 is not identified correctly by the technique just described, then a branch from logic step 64 to logic step 61 will once again initiate the code for finding the home position, as in block 61 and described above.

In logic block or step 65, the next logical step in the program is to go to the Data Encoding Algorithm portion of the program. In the pseudo code set forth above, this starts with the REM statement "Now translate measurement into physical bits". Now, assume that when coded, the encoder wheel 31 has several of the bits 0-6 covered, as by a decal so that light will not pass therethrough. Suppose all data bit slot but 6 and the stop window 55 are covered. A reading of distance D8/9 will give the spacing between the data slots or windows 0-6. Therefore, the distance to slot D7, i.e., the trailing edge of slot 6, will be 7 times "K" (bit spacing) and therefore will indicate that is a bit 7 that is emissive and that the bit representation is 1000000, or if the logic is inverted, 0111111. Notice that the number found is rounded up or down, as the case may be dependent upon such factors as paddle mass, rotational speed etc. In certain instances, this may mean rounding up with a reading above 0.2 and rounding down with a reading below 0.2. For example, 6.3 would be rounded to 7, while 7.15 would be rounded to a 7.

In logic step 66 the question is asked: "Does the machine stop during paddle rotation?" If it does, logic step 67 is initiated. The reason for this is that if the paddle is stopped, especially when in the portion of the sump 33 containing a quantity of toner 35, in order to release the torsion on the spring 44 the motor 15a is backed up several increments. This will allow removal, and/or replacement, if desired, of the EP cartridge 30. This logic steps allows for decrementing the number of steps "backed up" from the incremental count of motor increments which was started in logic block 62.

Turning now to FIG. 8B, as the encoder wheel 31 rotates, the paddle 34 enters the toner 35 in the sump 33. As described above relative to logic step 62, the motor increments are counted. The motor increments are then recorded as S200, S215 and S230, in logic step 68a, 68b and 68c at the trailing edges of slots "a", "b", and "c" respectively of the wheel 31. These numbers, S200, S215 and S230 are subtracted from the baseline of what the numbers would be absent toner 35 in the sump 33, (or any other selected norm) which is then directly indicative of the lag due to resistance of the toner in the sump, with the paddle 34 in three different positions in the sump. This is shown in logic steps 69a-69c respectively. As has previously been stated, there is a correlation between load torque on the toner paddle 34 and the amount of toner 35 remaining in the toner supply reservoir or sump 33. FIG. 9 illustrates this relationship. In FIG. 9, torque is set in inch-ounces on the ordinate and degrees of rotation of the paddle 34 on the abscissa.

Referring briefly to FIG. 9, several characteristics of this data stand out as indicating the amount of toner remaining. The first one is the peak magnitude of the torque. For example, with 30 grams of toner 35 remaining in the sump 33, the torque is close to 2 inch-ounces while at 150 grams the torque approximates 4 inches-ounces and at 270 grams the torque approximates 8 inch-ounces. The second characteristic is that the location of the peak of the torque curve

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does not move very much as the amount of toner changes. This suggests that measuring the torque near the location where the peak should occur could provide a measure of remaining toner. That is why, as shown in FIG. 7, the trailing edge of slot "a", (distance D9) is 200° from D0; the trailing edge of slot "b" (distance D10) is 215° from D0 and the trailing edge slot "c" (distance D11) is 230° from D0. Another obvious indicator is the location of the onset of the torque load. Yet a third indicator is the area under the torque curves.

Another way of looking at this process is that while the angular distance measurements of D9, D10 and D11 are known, the number of increments the motor has to turn in order that the resistance is overcome as stored in the torsion spring 44, is the difference in distance the motor has to travel (rotational increments) to obtain a reading at window "a", then "b" and then "c". The delay is then compared as at logic step 70 and 71, and the largest delay is summed as at logic steps 72, 73 or 74 to the rolling average sum. Thereafter a new average calculation is made from the rolling average sum. This is shown in logic step 75. As illustrated in logic block 76, the toner 35 level in the sump 33 may then be determined from a look up table precalculated and stored in the ROM 80a associated with EEC 80 in accordance with the new rolling average.

In logic block 77, the oldest data point is subtracted from the rolling average sum and then the rolling average sum is reported for use back to logic block 61 (Find Home position). If the toner level changed from the last measurement, as in compare logic block 78, this condition may be reported to the local RIP processor 90 and/or the host machine, e.g., a personal computer as indicated in logic block 79.

Coding of the encoder wheel 31 is accomplished, as briefly referred to above, by covering selected ones of slots 0-6 with a decal. For customization for an OEM vendee, and in order to reduce inventory, and in accordance with another feature of the invention, the problem of quickly and accurately applying such a decal to the correct area of the wheel 31, even under circumstances of limited space is provided. Due to the close spacing of the slots 0-6 in the encoder wheel 31, a pre-cut, preferably adhesive backed decal 96 is employed to selectively cover pre-selected slots depending on how the decal is cut or stamped. Very accurate positioning of the decal 96 is achieved by use of alignment pins in conjunction with an alignment tool 100. Because another decal can be placed on another region of the wheel, the spacing of the alignment holes 56-59 on the encoder wheel 31 is different in each region.

To this end, as previously discussed, there are two pairs of apertures in the encoder wheel or disk, adjacent the slots, the apertures of one of the pairs 58, 59 being spaced apart a greater distance than the apertures 56-57 of the other pairs. Referring now to FIG. 10a, decal 96 is sized to fit over at least one of the slots 0-2 or 3-6 to cover the same. As illustrated the decal 96 has spaced apart apertures therein corresponding to one of the pairs of apertures, i.e., 58, 59 or 56, 57. A tool 100 has a pair of pins 97, 98 projecting therefrom and corresponding to the spacing of one of the pairs of apertures, whereby when the apertures in the decal are mated with the projecting pins of the tool, the projecting pins of the tool may be mated with one pair of apertures in the encoder wheel or disk to thereby accurately position the decal over the selected slot in the disk. The decal 96 is installed on the tool with the adhesive side facing away from the tool. The tool 100 is then pushed until the decal 96 makes firm contact with the surface of the wheel.

If the pins 97 and 98 are spaced equal to the spacing between apertures 56 and 57, the decal cannot, once on the tool 100, be placed covering slots associated with the incorrect apertures 58 and 59. The opposite condition is also true. Accordingly, two such tools 100 with different pin 97, 98 spacing may be provided to insure proper placement of the correct decal for the proper slot coverage. Alternatively, a single tool 100 with an extra hole for receipt of a transferred pin to provide the correct spacing, may be provided.

This method of selective bit blocking is preferred because the process is done at the end of the manufacturing line where less than all of the wheel 31 may be exposed. Use of this tool 100 with differing spaced apart pins allows the operator to get to the encoder wheel 31 easily and prevents misplacement of the decal.

FIGS. 11A–11E are directed to refinements in the method of the invention depicted in FIGS. 8A and 8B. Such refinements include, for example, improvements in the code to further reduce the incidence of mistakes in location of the stop window 55 (or stop bit). As shown in FIG. 11A in comparison to FIG. 8A, additional steps 160, 161, and 162, are present wherein further logic associated with step 161 is depicted in FIG. 11C and further logic associated with step 162 is depicted in FIG. 11D. Furthermore, shown in FIG. 11B in comparison to FIG. 8B, and continuing into FIG. 11E, is a presently more preferred manner of determining, with somewhat greater accuracy, the amount of toner remaining in the sump (toner level) regardless of the speed of rotation of the paddle 34 and associated encoded plate, or encoder wheel, 31. In the following discussion, functional steps depicted in FIGS. 11A–11E which are common, or substantially similar, to those functional steps of FIGS. 8A and 8B will bear the same element numerals, and the detail of those common steps will not be repeated below.

As shown in FIGS. 8A and 8B, the steps associated with reading of the preselected cartridge characteristics and the steps associated with determining the toner level in sump 33 are performed in parallel. With respect to FIG. 11A and 11B, however, as shown at step 160, such parallel processing continues until the decoding of the preselected cartridge characteristics is successful, and thereafter, only the steps associated with determining the toner level in sump 33 (steps 66 and 67 of FIG. 11A, and the steps of FIGS. 11B and 11E) are performed. Such preselected cartridge characteristic may include, for example, initial cartridge capacity, toner type, PC drum type, qualified or unqualified as an OEM type cartridge, etc. One skilled in the art will recognize that such parallel processing may be achieved in a variety of ways, such as for example, by interleaving the program steps of the parallel paths within a single processor or by using a separate processor for each path.

Referring now to 11A, after machine 10 is started up, or after the printer cover has been opened and later closed, the variable identified as a "Rolling Average" is reset at step 60. The resetting of the Rolling Average occurs prior to executing the steps associated with reading the coding representing preselected cartridge characteristic from wheel 31, i.e., steps 61, 62, 160, 63, 161, 64, 65, and 162, and prior to determining the amount of toner remaining in sump 33 of cartridge 30 beginning at step 66, and continuing into FIGS. 11B and 11E.

In order for either the preselected cartridge characteristics steps or the toner level determining steps to properly, the "home position" of the wheel 31 must first be found, as at step 61. The previous discussion concerning the encoder

wheel 31 and the reading thereof to determine the home position of wheel 31 is equally applicable to the refinements depicted in FIGS. 11A–11E. Moreover, the pseudo code for "Reading the Wheel", discussed above is equally applicable for reading the encoder wheel, except that the portion of the code relating to the window width may be simplified, as follow:

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If (WindowWidth > Minimum Stop window Width
  AND CumulativeCount < Maximum Stop Position)Then
  'we must ensure that the stop window is really what we found
  Finished = True

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At step 62, the counting of increments of shaft rotation of the drive motor begins at the position associated with the trailing edge of start/home window 54. Therefore, at step 160, a check is made as to whether the coding representing preselected cartridge characteristics was successfully decoded. If this preselected cartridge characteristics coding was not successfully decoded, then the parallel progressing of the preselected cartridge characteristics and the determination of toner level continues; if so, however, such parallel processing ends, and only those steps associated with determining the toner level in cartridge 30 are performed.

During the decoding of the preselected cartridge characteristics of wheel 31, at step 63, the number of motor increments from the trailing edge of start window 54 to each of the data bit windows 0–6 and stop window 55, respectively, are recorded. Thereafter the steps of FIG. 11C are performed.

Turning now to FIG. 11C, a check is made at step 165 to determine if more than 7 bits have been seen between the home window 54 and the stop window or bit 55. If yes, then step 61 is re-executed and the home position is once again found. This test to detect and determine the presence or absence of an excess of a finite number of slots or bits on the encoder wheel 31 is preferred because as the wheel rotates, causing the sensor to detect either a transition from open to closed state or vice-versa, bounce may occur. If the bounce duration is very small, it will be rejected as a window (slot), otherwise it may pass and be considered a valid window. In such a scenario, certain cartridges may appear to have more bit windows than physically possible. After each bit window is detected, the number of bit window detected from the previous home detection is compared to a maximum value and if too many windows have been detected, then the code returns to the steps for finding the home state via path 194.

Another condition that can occur which makes a further check desirable is when the sensor signal transition from one state to the other and immediately back to the original state resulting in the indication of a detection of an additional, or redundant, window. A test for such a condition is performed at step 166. As shown in FIG. 7, and as has already been discussed, bit or slot distances on the wheel known and mapped. The identified of what appears to be two bits or slots in the same region on wheel 31 is identified as an error in reading the preselected cartridge characteristics for that particular revolution of wheel 31, and results in a return to re-execute of step 61 if FIG. 11A via path 194.

Referring again to FIG. 11C, step 167 is performed so as to assume that the code bits 0–6 are not mistake for the stop bits. Thus, at step 167 the number of motor increments counted is compared to a predefined maximum number of such increments associated with the distance between the trailing edge of home window 54 and the trailing edge of



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stop window 55. If the number of motor increments is not less than the predefined maximum number, then via return loop 194, step 61 of FIG. 11A is re-entered and this loop continues until a correct reading is achieved, or until an error code indicates a fatal error to the machine operator. If the number of motor increments is equal to or greater than the predetermined maximum number, then step 168 is executed, wherein it is determined whether the measured window or slot width is greater than the minimum stop width. If not, then step 63 is re-entered via path 184. In the event that the stop window 55 width is greater than the slot window width, then a check is made at step 169 to determine whether the duration (in motor increments) of closure of the reader/sensor is a sufficient number of increments to indicate a reading of stop window 55 versus the last bit read for example, slot 6. If slot 6 is covered, the distance or closure reading will be even longer. In the event that closure of the sensor has not occurred for a sufficient period of time then loop 184 line is again entered and logic step 63 is once again initiated. In the event that the closure of the sensor has occurred for a sufficient period of time, the step 65 of FIG. 11A is executed.

To further insure accurate reading of the encoder wheel 31, spring 44 is preloaded to a known torque value. Preferably, this preload value is as small as possible to allow for accurate reading of low levels of toner in sump 33. The preload may be achieved by, for example, providing an adjustable tab stop in place of either or both tabs 51 and 52 of FIG. 4. Such an adjustable tab stop can be, for example, a rotatable eccentric stop.

Step 65 is directed to the actual decoding of the preselected cartridge characteristic coding of encoder wheel 31, the details of which are more fully described with respect to the steps of FIG. 11D, which constitute step 162 of FIG. 11A. In the pseudo code set forth above, this starts with the REM statement "Now translate measurements into physical bits", and the discussion concerning distances and rounding applies. In table 170 of FIG. 11D, which may be referred to as a 'loop table', logic is utilized in a loop for each reading D1-D7 of the code wheel 31 (see FIG. 7), and takes into account the rounding discussed heretofore. Note that the "code registered" is the code which would be read at each of the respective bit positions corresponding to windows or slots 0-6, wherein a "1" represents an open slot at the respective bit position. The final code is a result of ANDing each column of bits in the seven "code registered" entries. For example, if none of the slots or windows is covered, then the final code reading will be 1111111; if slot 0 (FIG. 7) is covered, then the reading will be 1111110; and if slot 2 is also covered, the reading will be 1111010. Of course, such binary representations may be inverted such that a "1" represents a covered slot, rather than a "0".

The code read from the loop table 170 is then interpreted by a look up table at logic step 171 and the interpreted code is then sent to the EEC 80 in logic step 172. By a logical comparison, if the code is the same as that which is stored in NVRAM in EEC 80, as indicated in step 173, no further reading of the code is necessary and the decoding of the preselected cartridge characteristics coding of encoded plate, or wheel 31 is ended until the next occurrence of machine start-up or machine cover cycling. To decrease decode time, after the same code has been read consecutively twice, this code is stored in the NVRAM (logic step 175) for future comparisons and the steps for decoding the coding representing the preselected cartridge characteristic information is ended. In the event that the code has not been read twice, a counter is set with a "1", and as shown in logic

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step 174, the path via line 194 (FIG. 11A) is entered for re-reading the code beginning at step 61 of FIG. 11A.

Once the decoding of the preselected cartridge characteristic coding is complete the logic at step 160 then ignores further preselected cartridge characteristic code reading of wheel 31, and the method turns to solely reading the delay bits "a", "b", and "c" as discussed hereinafter relative to FIG. 11B, in determining the amount, or level, of toner in sump 33 of cartridge 30. In the presently preferred configuration of the encoder wheel 31, the trailing edge of slot "a", (angular distance D9) is 182° from D0; the trailing edge of slot "b" (angular distance D10) is 197° from D0 and the trailing edge of slot "c" (angular distance D11) is 212° from D0.

Referring again to FIG. 11A, the explanation for the logic steps 66 and 67 is the same as set forth heretofore and will not be repeated here. However, in further explanation, when reverse motion is detected a counter counts the number of back increments or steps and that same number is applied or subtracted as the motion is reversed to forward so that the count is resumed when the wheel begins its forward motion again. For example, in a single page print job, the encoder wheel will stop before a full revolution is complete. The machine will run the transport motor in reverse for a short distance after each stop in order to relieve pressure in the gear train. As set forth above, this permits, if desired, cartridge removal and/or replacement. Without correction, this could induce a considerable error in measurement of toner level. To account for this, the amount of excess motor pulses counted during the backup and restart are filtered out of the delay counts measured for toner level sensing.

Turning now to FIG. 11B, as has been explained heretofore with reference to FIG. 8B, as encoder wheel 31 rotates, paddle 34 enters toner 35 in sump 33. As set forth heretofore with reference to FIG. 8B, the angular distances of D9, D10 and D11 are known and the number of no-load motor increments required to reach D9, D10 and D11 is known. The motor, via torsion spring 44, rotates paddle 34 and encoder wheel 31. As paddle 34 moves through toner 35, however, a paddle-to-toner resistance is incurred, which results in a torsioning of torsion spring 44, since the motor is essentially rotating at a constant rate. Thus, the actual number of motor increments required to reach each of the respective locations D9, D10, and D11 is greater during a load condition when paddle 34 engages an amount of toner than when a lesser amount or no toner is engaged. This difference in the distance the motor has to travel (rotational increments) to obtain a reading at window "a", then "b" and then "c" corresponds to a level of toner in sump 33.

As described above relative to logic step 62 (FIG. 11A), the motor increments are counted. The motor increments are then recorded as S200, S215 and S230 in steps 68a, 68b and 68c (FIG. 11B) at the trailing edges of slots "a", "b", and "c", respectively, of the wheel 31, and subtracted from the baseline of what the number would be absent toner 35 in the sump 33, at steps 69a, 69b, and 69c, respectively. These numbers are directly indicative of the lag due to resistance of the toner sump 33, with the paddle 34 in three different positions (a, b, and c) in the sump. Thus, this lag or delay is determined and shown in steps 69a-69c, respectively. As has been previously stated, there is a correlation between load torque on the toner panel 34 and the amount of toner 35 remaining in the toner supply reservoir or sump 33. (See FIG. 9 and the discussion relating thereto.)

At steps 70 and 71, the respective baseline normalized delays are compared, and one of the three delays is selected

for use in determining the toner level of cartridge 30 at the then current printer operating speed in pages per minute (ppm) at steps 72', 73', or 74'. As shown in FIG. 11B at step 70, the normalized delay @200 will be used to calculate the toner level unless its value is not greater than that of normalized delay @215. If the normalized delay @200 is less than or equal to normalized delay @215, then at step 71 it is determined whether normalized delay @215 is greater than normalized delay @230. If so, then the normalized delay @215 is used, and if not, then normalized delay @230 is used in the toner level determination. Alternatively, a maximum normalized delay figure can be used in the toner level calculation.

Preferably, the normalized delay selected in the toner level determination is sent to an equation for calculating the toner level mass (in grams of toner) at a particular machine speed in pages per minute (ppm). The equation to determine, at different ppm printing speeds, the mass in grams of toner remaining in the cartridge is the linear equation:  $y=mx+b$  where:

$m$ =slope measurement in grams/pulse (or increments);

$b$ =y axis intercept, or offset, where  $x=0$  grams; and

$x$ =average number of pulses, or increments. The values for variables  $m$  and  $b$  are essentially constants with respect to various printing speeds. These values may be determined empirically, or calculated or determined base upon assumptions. For example, the following table represents the values for variables  $m$  and  $b$  assuming 10.80 motor pulses per degree of encoder wheel rotation.

| 8 ppm |     | 12 ppm |     | 18 ppm |     | 24 ppm |     |
|-------|-----|--------|-----|--------|-----|--------|-----|
| $m$   | $b$ | $m$    | $B$ | $m$    | $b$ | $m$    | $b$ |
| .18   | 55  | .19    | 52  | .21    | 48  | .23    | 45  |

Using the above table, for example, for an 8 ppm operating speed, the equation above becomes:  $y=0.18x+55$ . Accordingly, if  $x=100$ , then it is determined that 73 grams of toner remain in sump 33.

It has been found that with a single speed machine, i.e., one that runs at a single speed of rotation of the drum, a rolling average of the delays measured permits calculating toner level, in grams, from the outcome of that average. Under those limited circumstances, the toner level in the sump 33 may then be determined from a look up table precalculated and stored in the ROM 80a associated with the EEC 80 in accordance with the new rolling average. Many printers, however, are capable of multiple resolutions which may require different motor speeds, e.g., 300 dpi (dots per inch), 600 dpi, 1200 dpi, etc., which means that this manner of determining the amount of toner left in the cartridge would be accurate for only one speed. Moreover, delay is a function of both paddle velocity and toner level. In the instance where a printing job requires alternate printing at 600 and 1200 dpi the machine runs at a different speed for each of these resolutions, and the toner level measurement is difficult to determine by the rolling average method because the rolling average contains delays measured at all of those speeds. To account for this, the rolling average is taken of a velocity independent parameter, i.e., grams. The equation given above converts the measurements of maximum delays immediately to grams as in logic steps 76'. The rolling average is then taken of grams, a speed independent

parameter, and therefore velocity changes will not affect the toner level measurement. This is shown in logic step 75'.

Following step 75', the steps of FIG. 11E are performed in preparing to report a toner level or toner low indication, for example, to the EP machine and/or an attached computer. At step 176, the first value of the rolling average from logic step 75' is stored. Subsequent values are stored as AVG2 for comparison to MINAVG. In decision step 177, the value for the rolling average (AVG2) is compared to the previous value MINAVG. If AVG2 is not less than MINAVG, (which would be the normal situation), AVG2 is cleared in logic step 179, and AVG2 is reset with the next value of the rolling average. If the comparison is affirmative, then a further test is performed at step 178 to determine whether the difference between the two readings is logical. If the difference is less than 30 (grams), then the reading is considered logical. If, on the other hand, the difference is greater than or equal to 30, then the reading discarded as being noise and once again logic block 179 is entered for clearing AVG2 and resetting it with the next value of the rolling average. If the comparison value is less than 30 at step 178, the MINAVG is set equal to AVG2 at step 180 and sent to steps 179 and 181 in parallel. Depending upon the machine, it has been discovered that it may be desirable to add a scale factor to MINAVG, such as for example, a scale factor (SF) of 3 grams, as is shown at step 181.

The amount of toner held in the sump 33 of a cartridge 30 can vary. Standard toner quantity, measured in grams for a full cartridge, is approximately 400 grams. A user would prefer to know how much is left for use in the machine, e.g., is the sump 33 is half full,  $\frac{3}{4}$  full, or  $\frac{1}{4}$  full, and this is achieved at step 182. The result of step 181, i.e., MINAVG+3 grams is looked up in the ROM 80a of the EEC card 80 (see FIG. 6). Moreover, as shown in logic step 182, if the toner level increases (as it occasionally does due to noise and unless the cartridge has been replaced since the last measurement), this reading is ignored and the previous toner level is posted as the current level. At step 79', the ROM output returns a sump level to the local machine processor for a direct reading on a printer display, or it sends the reading to the host computer.

Thereafter, the process returns to step 77' of FIG. 11B, in which the oldest delay value from the five held in generating the rolling average is removed. At step 78', the process then delays X steps, or increments, after the first toner level slot before searching for the "home position", i.e., before returning to step 61 of FIG. 11A. The number of steps X, is chosen to ensure that the third toner level slot has passed the sensor. Thereafter, steps 62, 160, 66, of FIG. 11A are completed, and the steps of FIGS. 11B and 11E for determining the toner level in sump 33 of cartridge 30 are repeated.

One skilled in the art will recognize that an encoder plate, such as encoder wheel 31, may be fabricated, for example, by forming slots, or openings, in a material. Such a material is preferably disk-shaped, and may, for example, be made of plastic or metal. Although the disk-shaped design is preferred, other shapes may be used without departing from the spirit of the invention.

Also, one skilled in the art will recognize that the windows, or slots, may be free of any material, or alternatively, filled with a transparent material. In addition, it is contemplated that the encoder 31 could be fabricated, for example, from a transparent material having a coating deposited thereon which defines the coding, such as for example, by defining the edges of each window, and in which the coating does not effectively transfer light impinging on its surface.

FIGS. 12–16 show further illustrative embodiments of an encoded wheel corresponding generally to encoder wheel 31 depicted in FIGS. 1–3, and 7. For example, and referring first to FIG. 12, the encoder wheel 31 may be replaced by an identically slotted wheel 131 composed of a ferromagnetic material. The reader/sensor 131a, in this instance, may include an alternative energy source such as a magnet 132 and the receptor or receiver may comprise a magnetic field sensor, such as a Hall effect device, 133 in place of the optical encoder wheel reader/sensor 31a. In operation, the ferromagnetic material of the encoder wheel 131 blocks the magnetic flux emanating from the permanent magnet 132 except where there are slots 135 in the wheel 131. Either the Hall effect device 133 or the magnet 132 may be attached to one of or both the printer 10 or cartridge 30.

In another example, and referring now to FIGS. 13 and 14, an encoder wheel 231 may be employed in association with another reader/sensor 231a. In this embodiment, in lieu of slots or windows in the wheel, such as in encoder wheels 31 and 131, such slots or windows are replaced with reflective material 235. In this scheme, the encoder wheel reader/sensor 231a includes a light source 232 and light sensor or receiver 233 which is activated as the encoder wheel rotates and the light from the light source is reflective from the reflective material 235. In comparing the windows or slots of the encoder wheel 31 and the reflective material 235 of wheel 231, it should be noted that the Start/Home window 54 in FIG. 7 corresponds to the Start/Home window (reflective material) 154 in FIGS. 13 and 14, while the information slots 0 and 1 of the encoder wheel 31 in FIG. 7, correspond to the reflective material 235 at 0' and 1' of FIG. 14. Preferably, the wheel 231 should be made of a non-reflective material to avoid scattered or erroneous readings by the optical reader 233. An advantage of this type of structure is that the reader/sensor 231a need be only on one side of the encoder wheel, simplifying machine and toner cartridge design.

The design of an encoder wheel 331 in FIGS. 15 and 16 may be similar, employing a cam follower actuated reader/sensor 331a. In these embodiments, the encoder wheel 331 includes a circumferentially extending cam surface 340 on the periphery of the encoder wheel, wherein the periphery acts as cam lobes 341 with appropriate cam recesses or depression 342. In comparing the windows or slots of the encoder wheel 31 and the cam recesses or depressions 342, it should be noted that the Start/Home window 54 in FIG. 7 corresponds to the Start/Home recess 354 in FIGS. 15 and 16, while the information slots 0 and 1 of the encoder wheel 31 in FIG. 7, correspond to the cam recesses 342 at 0' and 1' of FIGS. 15 and 16.

The cam followers 360 and 370 of FIGS. 15 and 16, respectively, may take multiple forms, each cooperating with a reader/sensor 331a. The reader/sensor may take many forms, for example a micro-switch which signals, upon actuation, a change of state; or it may be similar to the reader/sensor 31a or 131a, except that the cam followers act to interrupt the energy source and receptor or receiver associated with their own reader/sensor 331a.

In the embodiment of FIG. 15, the cam follower 360 is formed as a bar or arm 361 pivoted on a shaft 362, which in turn is attached, for example, to an appropriate portion of the cartridge 30. Thus, arm 361 acts in pressing engagement with the cam surface 341 due to the action of biasing spring 365. As shown, the biasing extension spring 365 is connected to one end 363 of the bar or arm 361 and anchored at its other end, preferably, to cartridge 30. The cam engaging terminal end of the arm or bar may include a roller 366

to reduce sliding friction. The opposite or energy interrupter end 364 of the bar or arm 361 is appropriately located for reciprocation about the pivot 362.

In the embodiment of FIG. 16, the cam follower 370 takes the form of a reciprocating bar 371 having a centrally located, cam follower throw limiter slot 372, with locating and guide pins 373 and 374 therein for permitting reciprocation (as per the arrow 379) of the bar 371. As shown, one terminal end 375 of the bar 371, may include a roller 376 for pressing engagement against the cam surface 341. To ensure proper following of the follower 370, a biasing extension spring 377 biases the roller 376 of the bar 371 against the rotating cam surface. As in the embodiment of FIG. 15, the follower bar 371 includes an energy interrupter portion 378 for reciprocation into and out of the path between the energy source and receptor of the reader/sensor 331a.

Thus, the present invention provides a simple yet effective method and apparatus for transmitting to a host computer or machine of a type employing toner, information concerning the characteristics of an EP cartridge. Such information can include continuing data relating to the amount of toner left in the cartridge during machine operation and/or preselected cartridge characteristic information. Still further, the present invention provides a simplified, but effective, method and means for changing the initial information concerning the cartridge which means and method is accurate enough and simple enough to allow for either in field alterations or end of manufacturing coding of the EP cartridge.

Although the invention has been described with respect to preferred embodiments, those skilled in the art will recognize that changes may be made in form and in detail without departing from the spirit and scope of the following claims.

What is claimed is:

1. An encoded device for a toner cartridge comprising a plate having preprogrammed indicia positioned at locations defined in relation to a clock face, said preprogrammed indicia including a start indicia positioned at about a 6:00 o'clock position and at least one measurement indicia located between about 200 degrees and about 230 degrees from said 6:00 o'clock position.
2. The encoded device of claim 1, wherein said start indicia is positioned between about a 5:00 o'clock position and said 6:00 o'clock position.
3. The encoded device of claim 1, wherein each said indicia comprises a slot.
4. The encoded device of claim 1, wherein the location of said at least one measurement indicia is determined in one of a clockwise and a counterclockwise direction from said 6:00 o'clock position.
5. The encoded device of claim 1, further comprising at least one preselected cartridge characteristic indicia positioned between said start indicia and said at least one measurement indicia.
6. The encoded device of claim 1, further comprising at least one preselected cartridge characteristic indicia positioned between said start indicia and said at least one measurement indicia in a clockwise direction from said 6:00 o'clock position.
7. The encoded device of claim 1, wherein said at least one measurement indicia comprises a plurality of measurement indicia.
8. The encoded device of claim 1, wherein each of said at least one measurement indicia comprises a slot.
9. The encoded device of claim 1, wherein said plate comprises a circular disk.
10. The encoded device of claim 1, wherein said toner cartridge includes a sump for carrying a supply of toner and



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an agitator rotatably mounted in said sump, said agitator having a first end and a second end, said plate being coupled to said first end of said agitator and a torque sensitive coupling being coupled to said second end of said agitator.

11. An encoded device for a toner cartridge comprising a plate having preprogrammed indicia positioned at locations defined in relation to a clock face, said preprogrammed indicia including a first slot positioned at about a 6:00 o'clock position and having a first extent, and a measurement slot positioned at between about 200 degrees and about 230 degrees from said 6:00 o'clock position, said measurement slot having a second extent, said first extent being greater than said second extent.

12. The encoded device of claim 11, wherein a location of said measurement slot is determined in one of a clockwise and a counterclockwise direction from said 6:00 o'clock position.

13. The encoded device of claim 11, further comprising at least one preselected cartridge characteristic indicia positioned between said first slot and said measurement slot.

14. The encoded device of claim 11, wherein said toner cartridge includes a sump for carrying a supply of toner and an agitator rotatably mounted in said sump, said agitator having a first rotating end and a second rotating end, said plate being adapted for coupling to said first rotating end of said agitator.

15. The encoded device of claim 14, wherein said second end of said agitator is coupled to a torque sensitive coupling.

16. The encoded device of claim 11, wherein said plate is a rotatable disk.

17. An encoded wheel for a toner cartridge comprising a disk having indicia positioned at locations on said disk, said

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indicia including a start indicia, and at least one measurement indicia located between about 200 degrees and about 230 degrees from said start indicia.

18. The encoded device of claim 17, wherein each said indicia comprises a slot.

19. The encoded device of claim 17, wherein the location of said at least one measurement indicia is determined in one of a clockwise and a counterclockwise direction from said start indicia.

20. The encoded device of claim 17, further comprising at least one preselected cartridge characteristic indicia positioned between said start indicia and said at least one measurement indicia.

21. The encoded device of claim 17, further comprising at least one preselected cartridge characteristic indicia positioned between said start indicia and said at least one measurement indicia in a clockwise direction from said start indicia.

22. The encoded device of claim 17, wherein said at least one measurement indicia comprises a plurality of measurement indicia.

23. The encoded device of claim 17, wherein each of said at least one measurement indicia comprises a slot.

24. The encoded device of claim 17, wherein said toner cartridge includes a sump for carrying a supply of toner and an agitator rotatably mounted in said sump, said agitator having a first end and a second end, said disk being coupled to said first end of said agitator and a torque sensitive coupling being coupled to said second end of said agitator.

\* \* \* \* \*

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UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office

December 31, 2009


THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: 6,459,876

ISSUE DATE: *October 01, 2002*

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
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P. SWAIN  
Certifying Officer

US006459876B1

(12) **United States Patent**  
**Buchanan et al.**

(10) **Patent No.:** **US 6,459,876 B1**  
(45) **Date of Patent:** **Oct. 1, 2002**

(54) **TONER CARTRIDGE**

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(73) **Assignee:** **Lexmark International, Inc.,** Lexington, KY (US)

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) **Filed:** **Jul. 18, 2001**

(51) **Int. Cl.<sup>7</sup>** ..... **G03G 15/08**

(52) **U.S. Cl.** ..... **399/254; 366/309; 366/311; 399/263**

(58) **Field of Search** ..... 399/263, 254, 399/256; 366/154.1, 156.1, 157.1, 157.2, 309, 342, 343, 155.1, 158.1, 311, 312, 313

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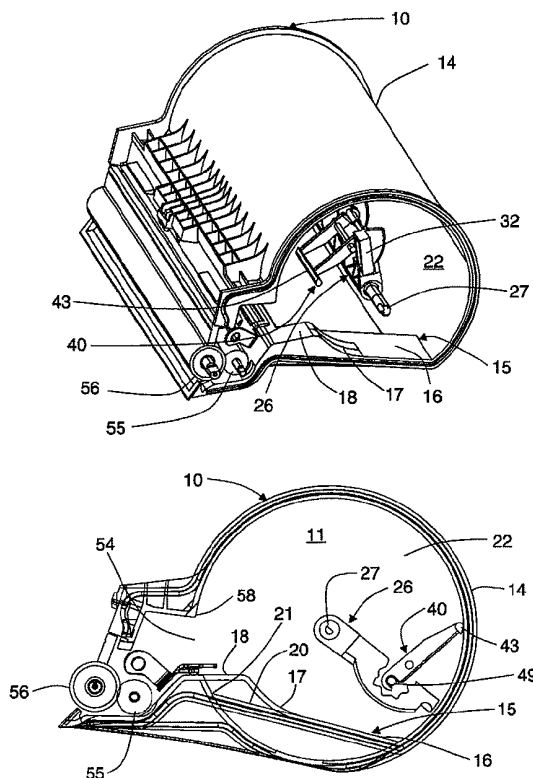
*Primary Examiner*—Susan S. Y. Lee

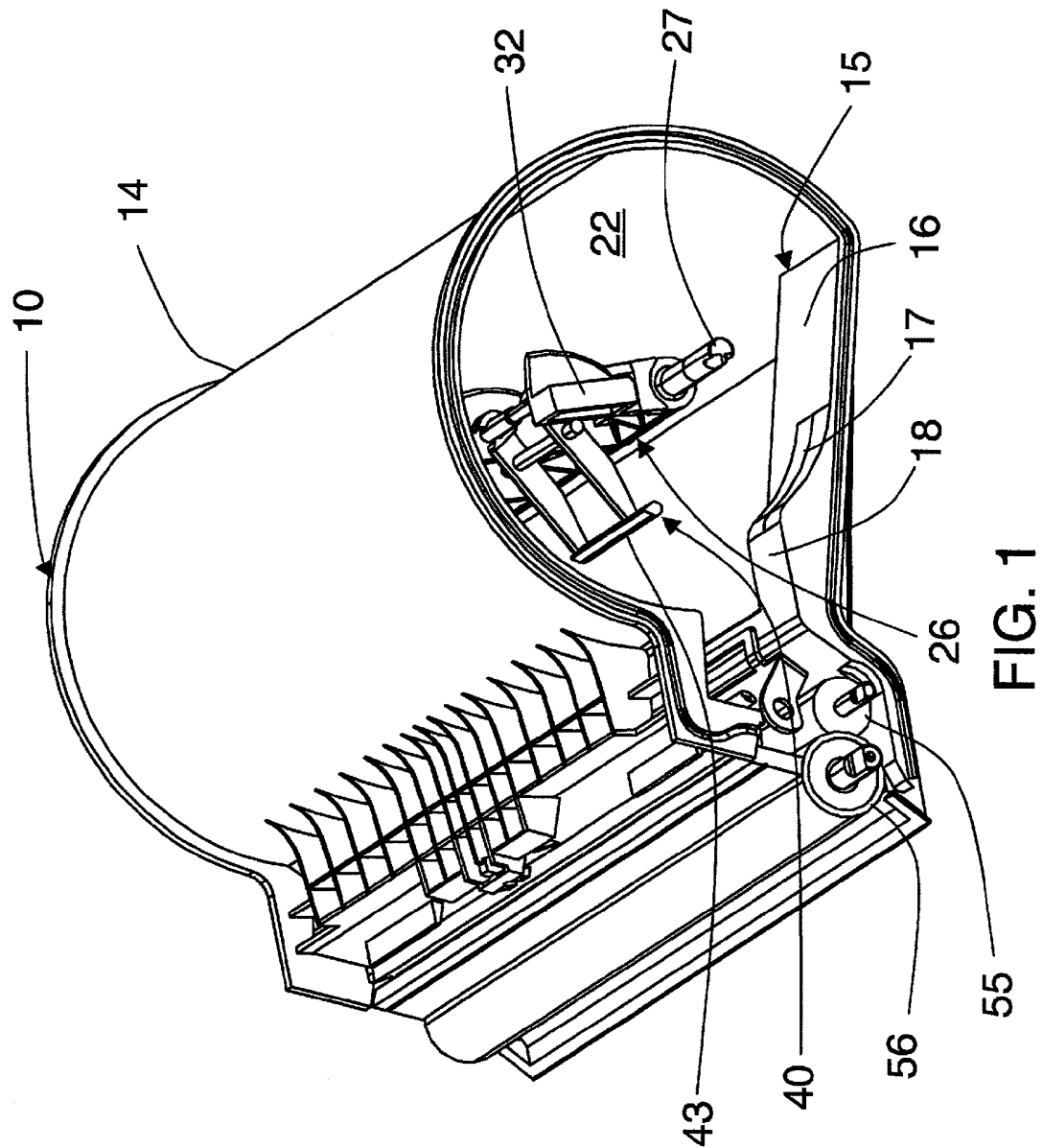
(74) *Attorney, Agent, or Firm*—John A. Brady

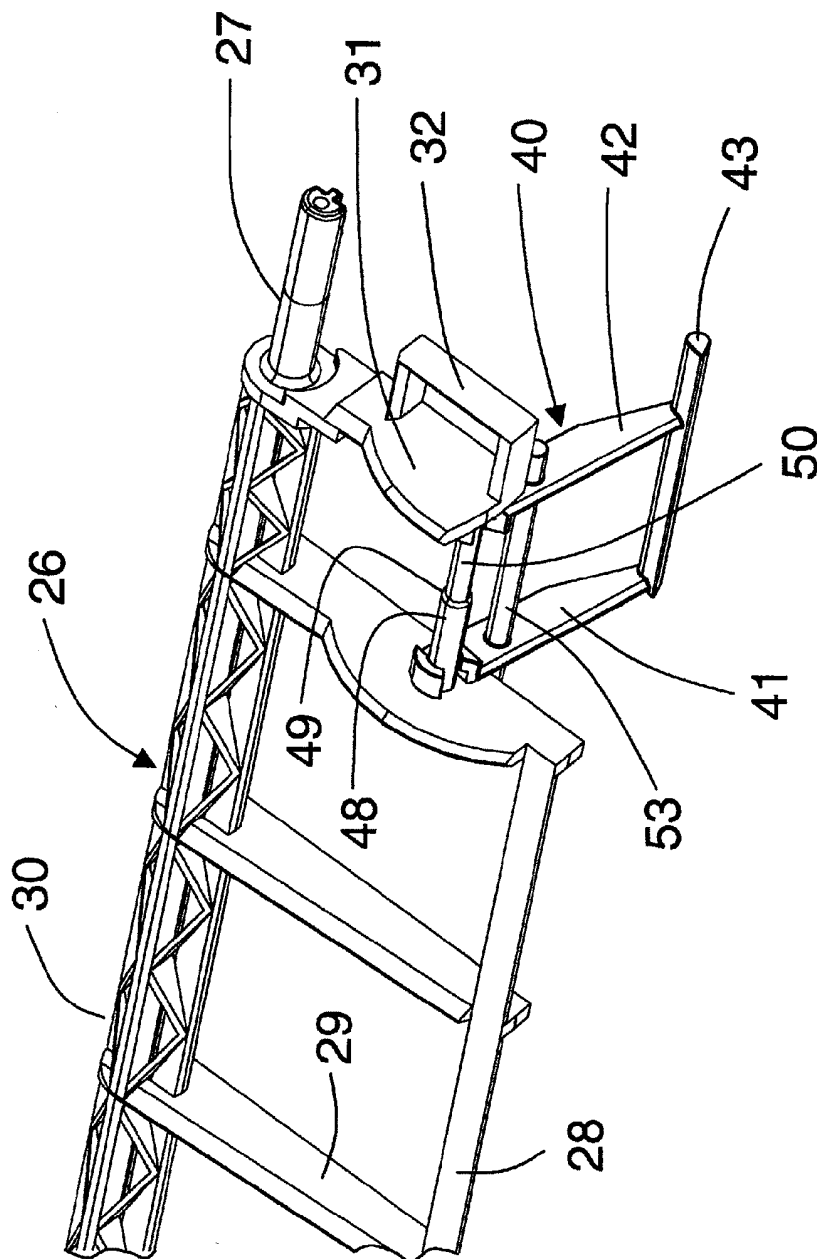
(57) **ABSTRACT**

A toner cartridge for use in a laser printer has a toner reservoir or hopper in which a first paddle rotates about a fixed first axis to sweep most of the toner volume of the cartridge to agitate and push the toner out of the toner reservoir or hopper through an exit port. A second paddle is pivotally mounted on the first paddle to sweep a volume of the toner reservoir or hopper in which a portion of the longitudinal wall of the toner reservoir or hopper of the toner cartridge is non-circular so as to produce a reduced cross section in the toner reservoir or hopper. The second paddle also initially engages the curved portion of the inner surface of the longitudinal wall of the toner reservoir or hopper and preferably has a tear drop cross section.

**28 Claims, 17 Drawing Sheets**







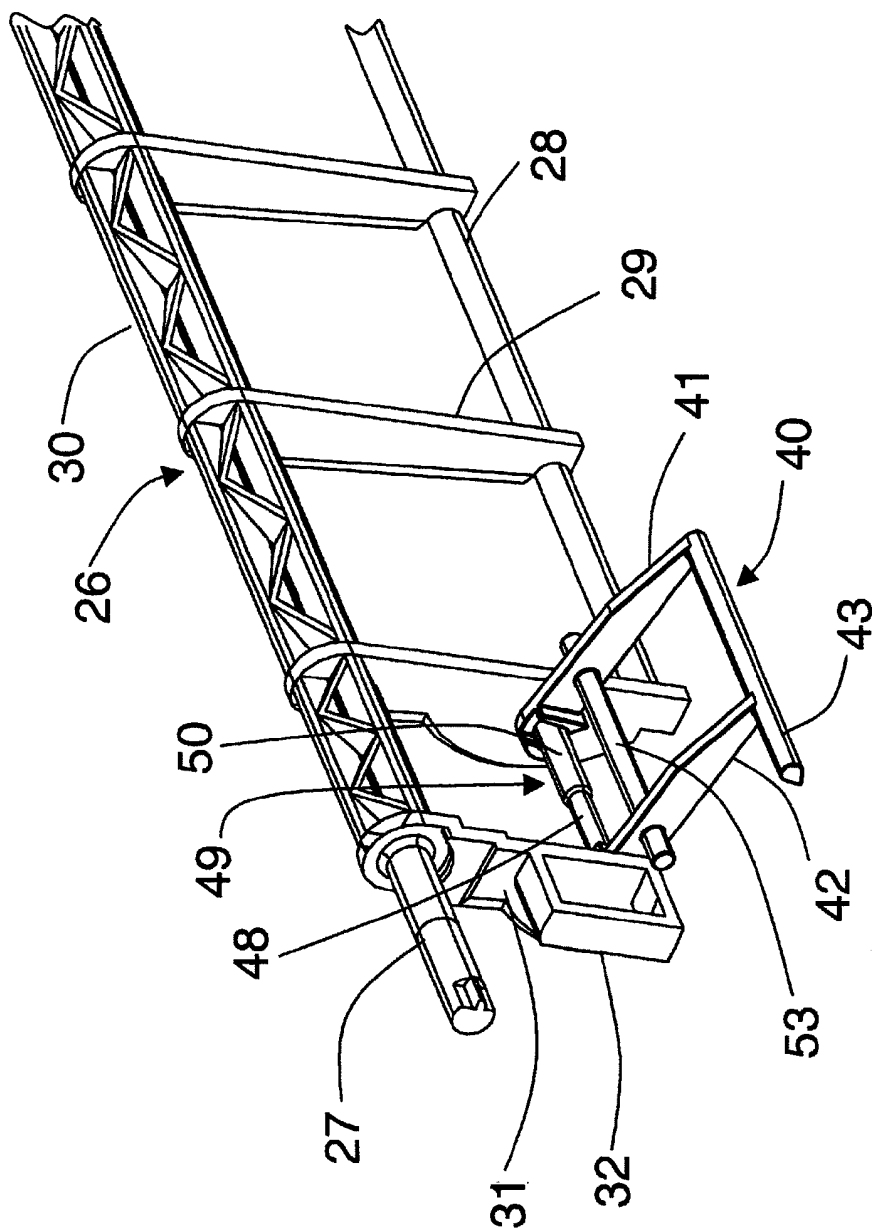


FIG. 3



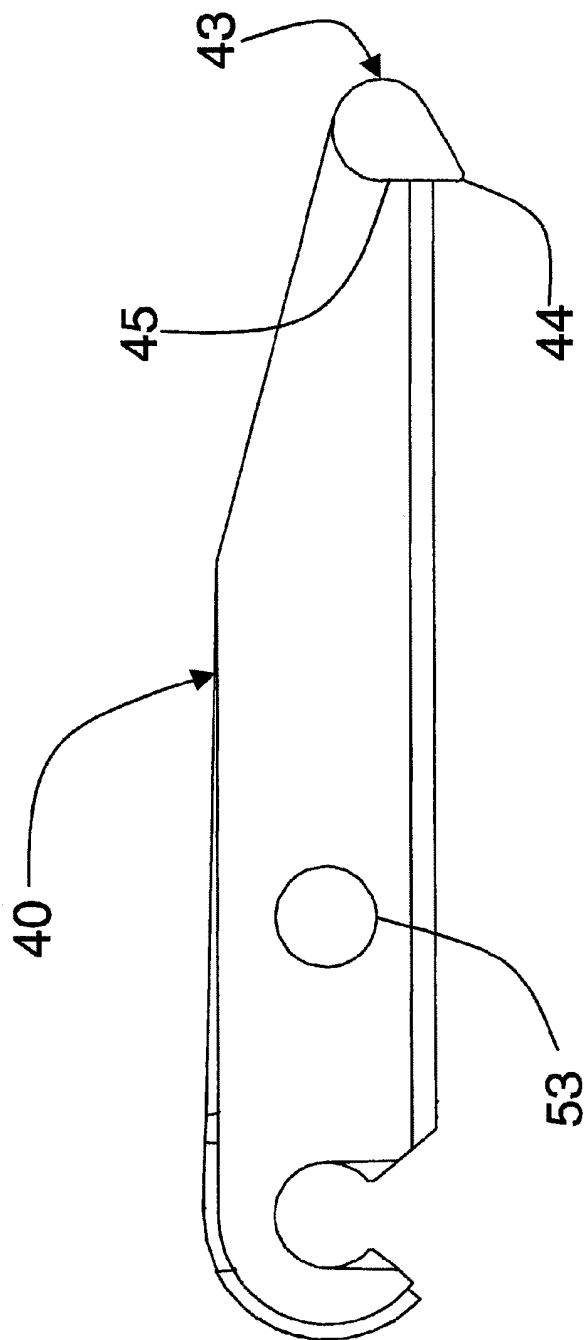


FIG. 4

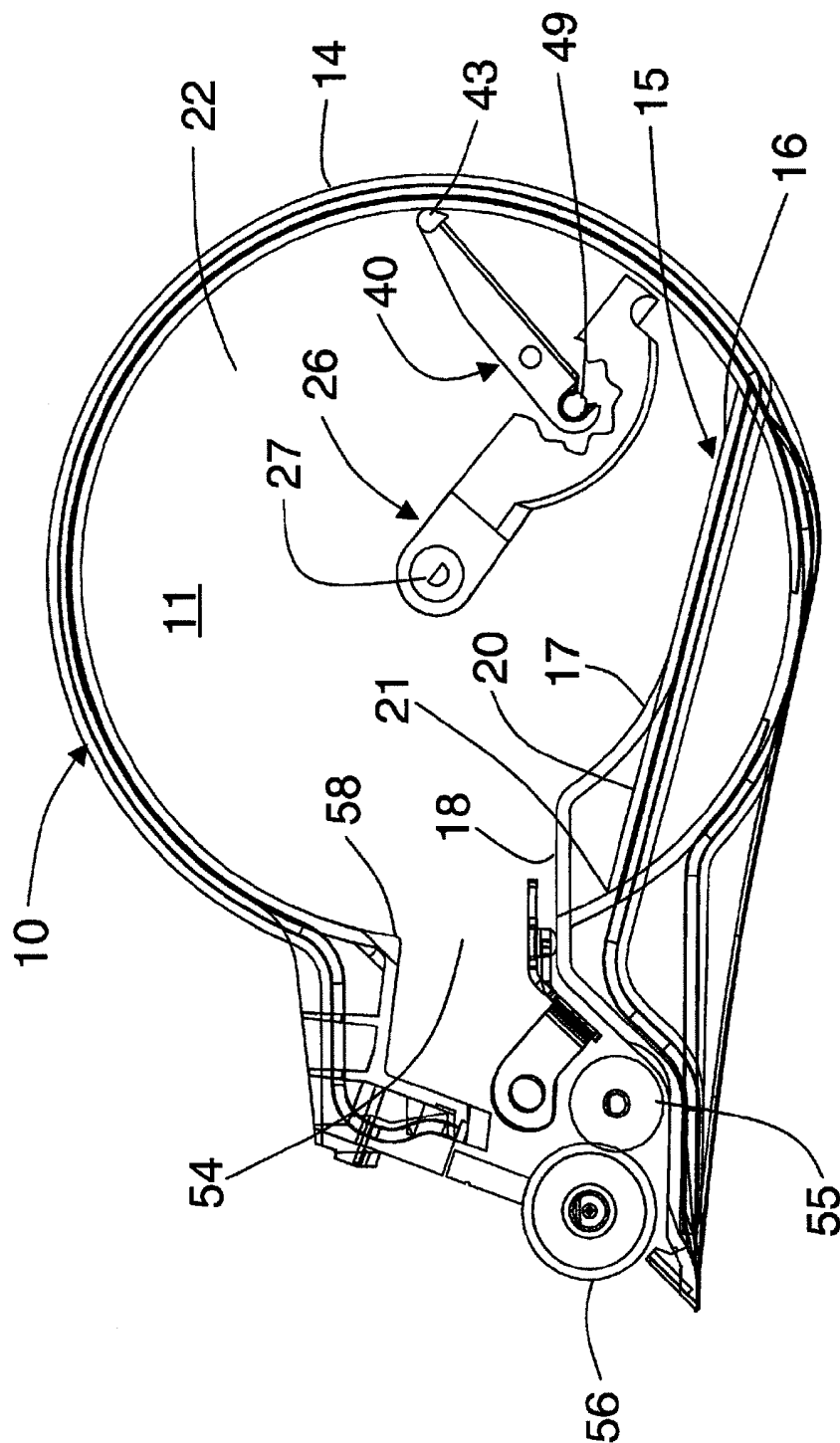


FIG. 5

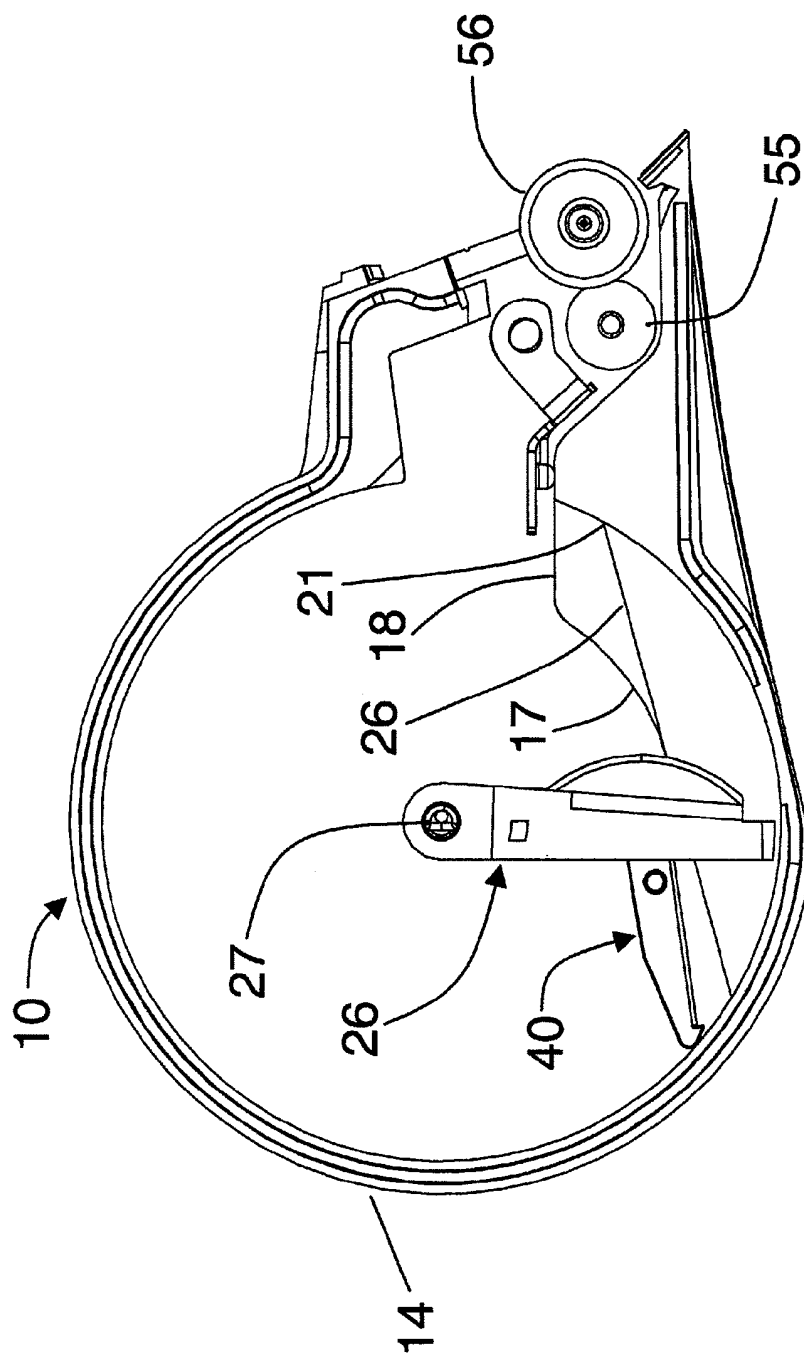


FIG. 6

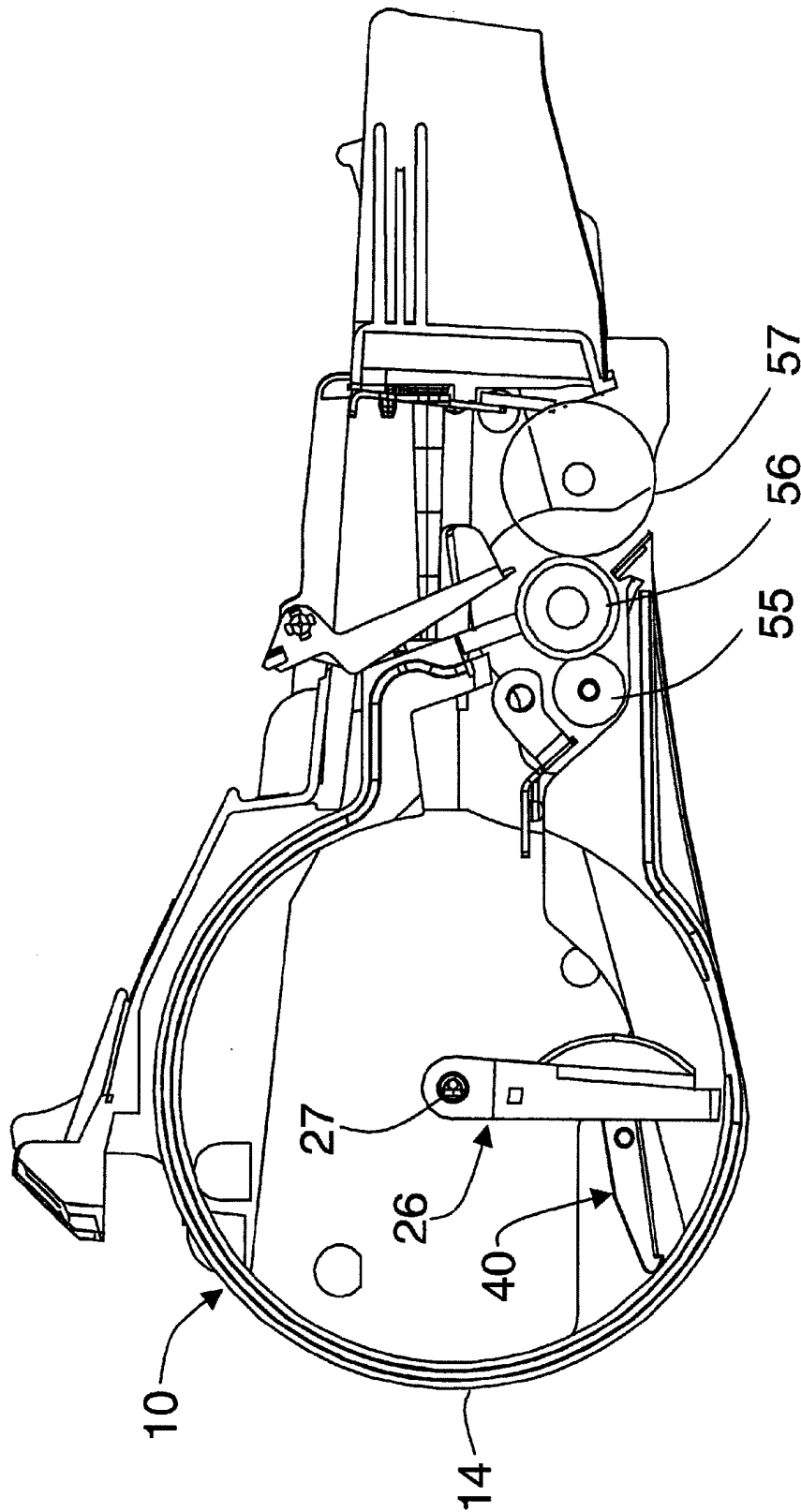


FIG. 7

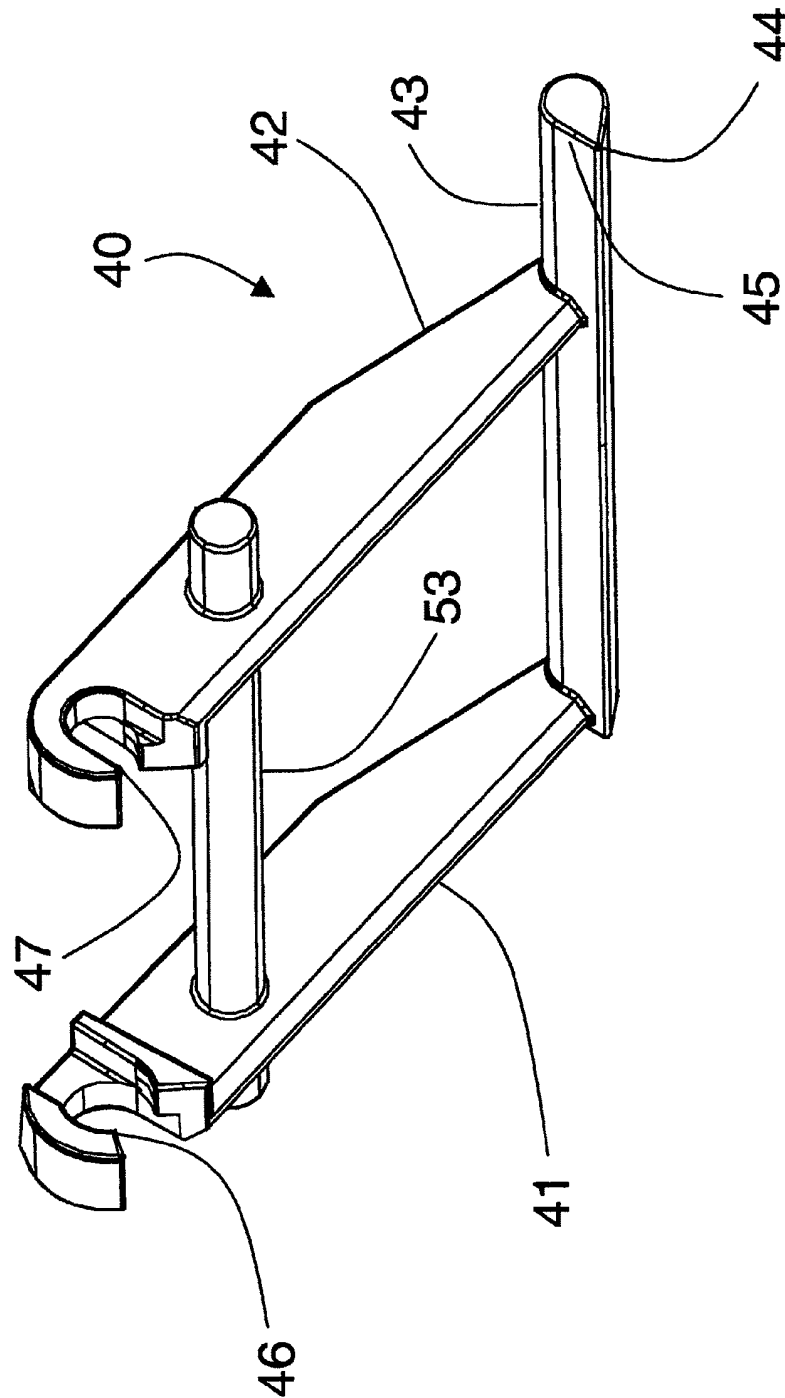


FIG. 8

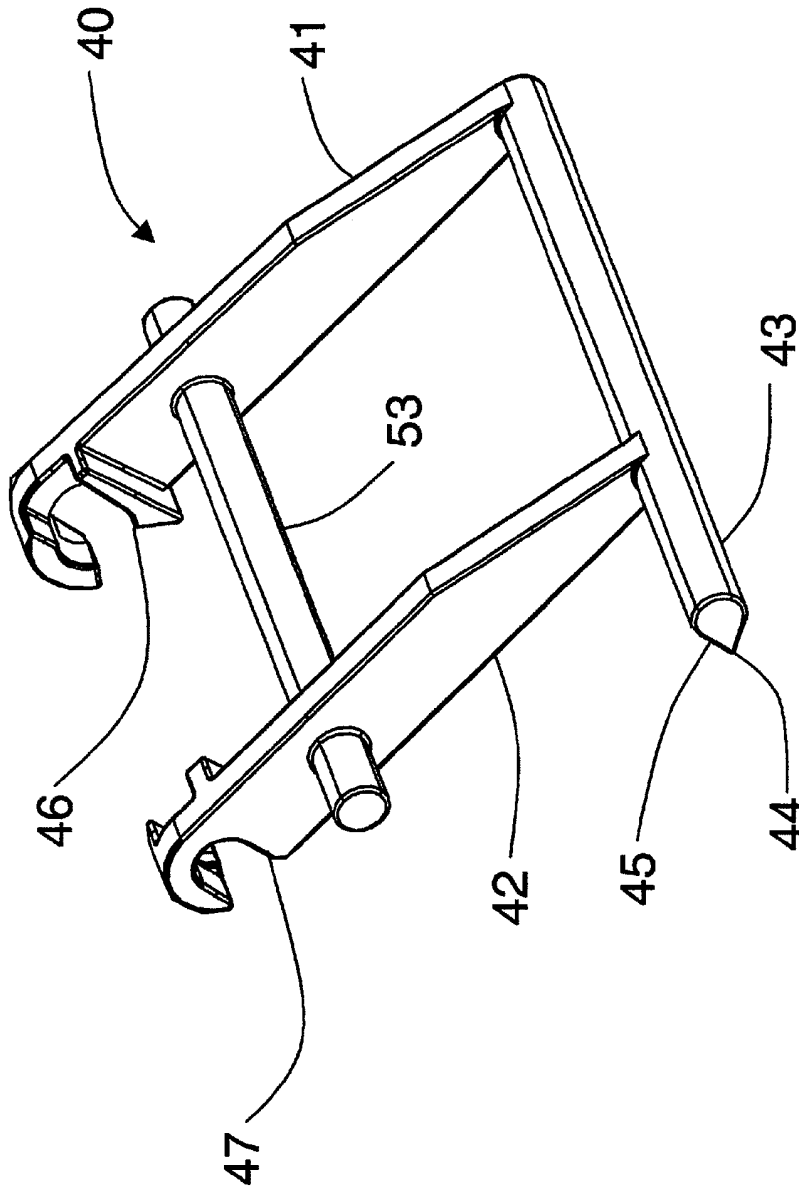


FIG. 9



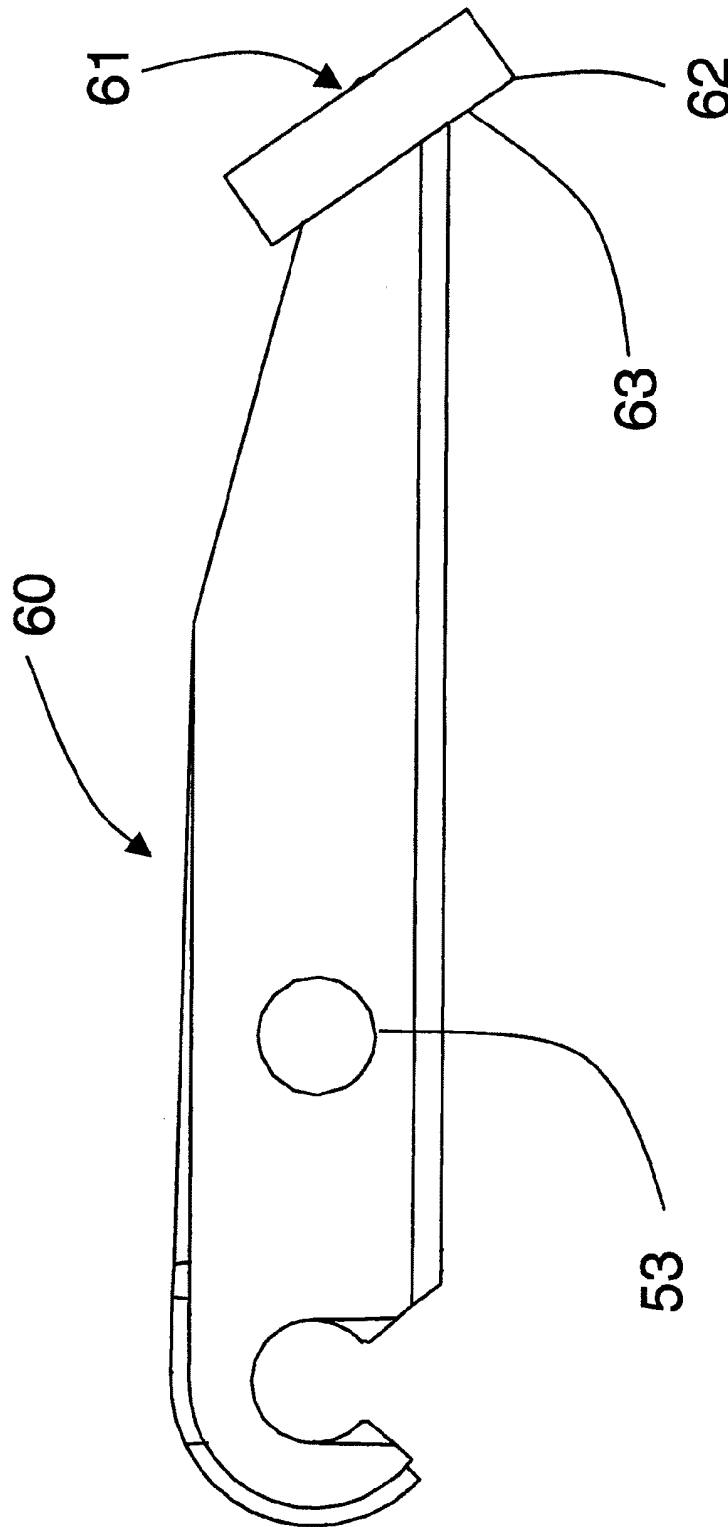


FIG. 10

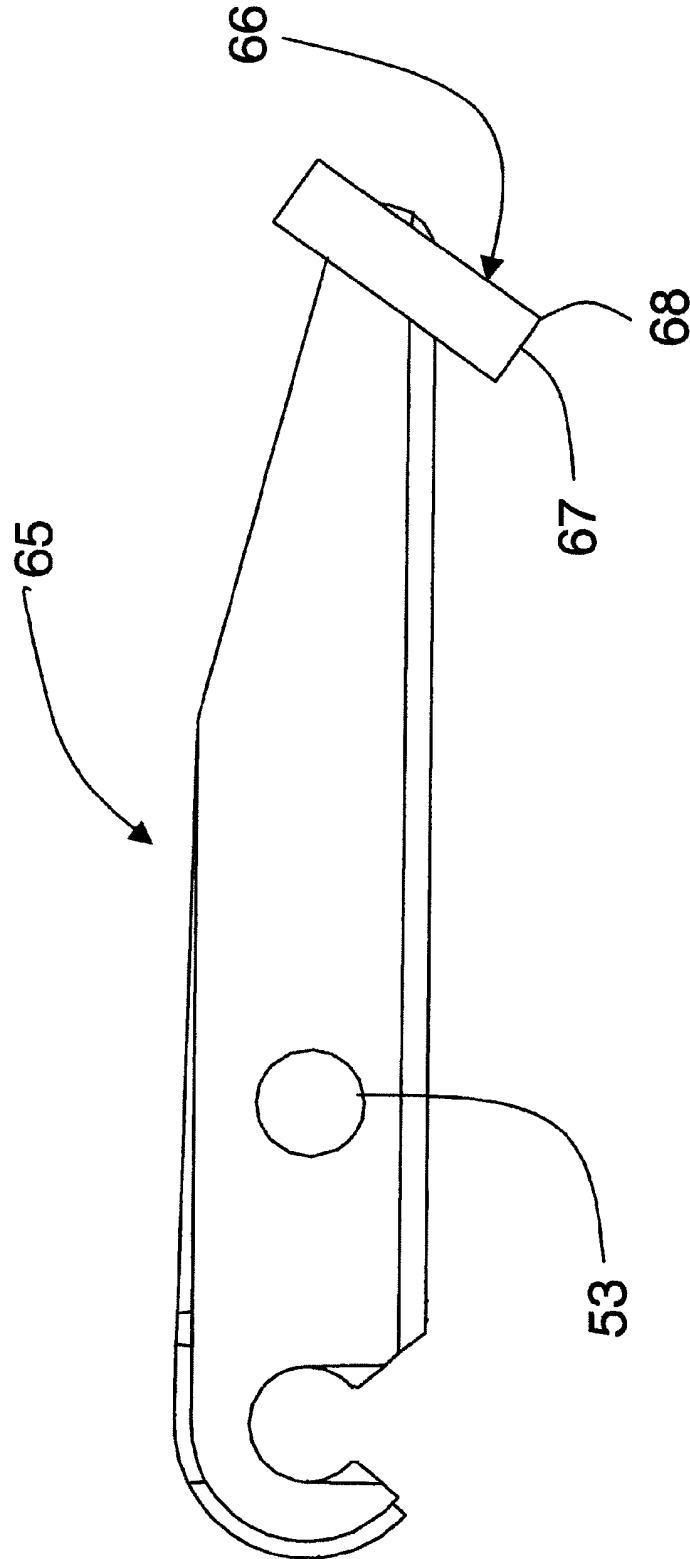


FIG. 11

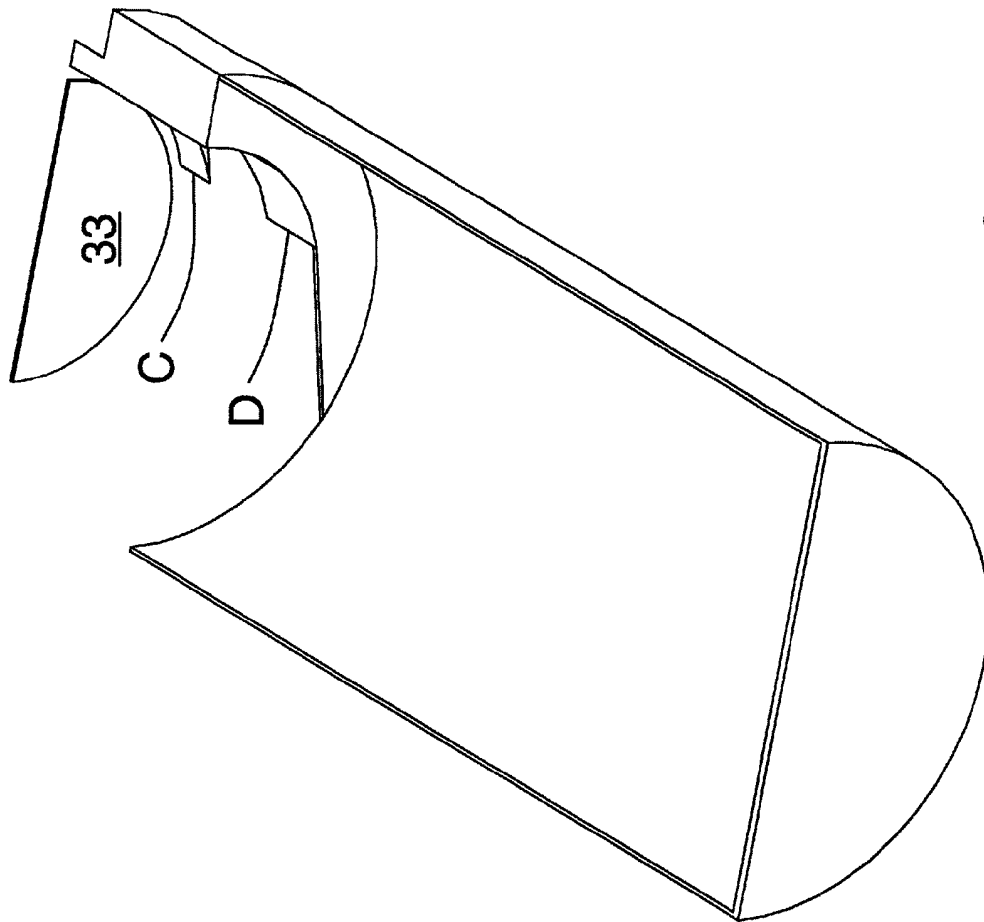
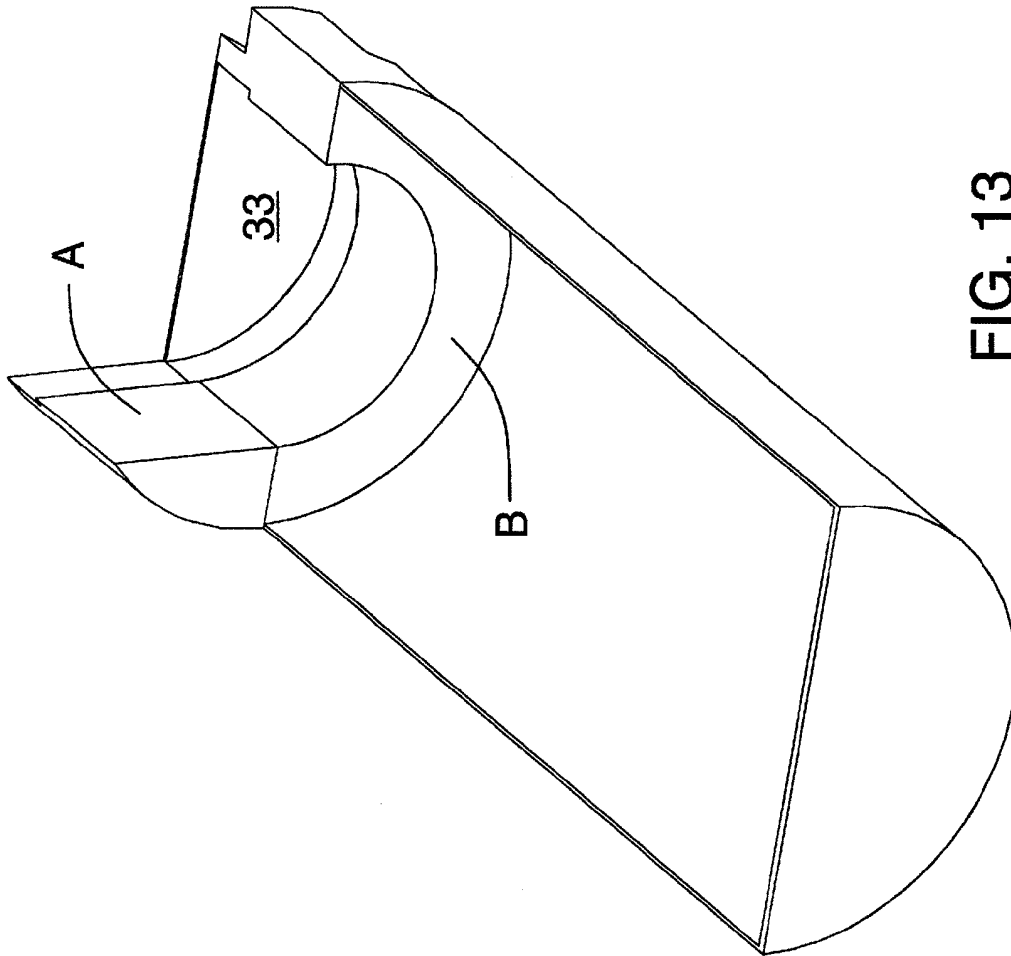


FIG. 12



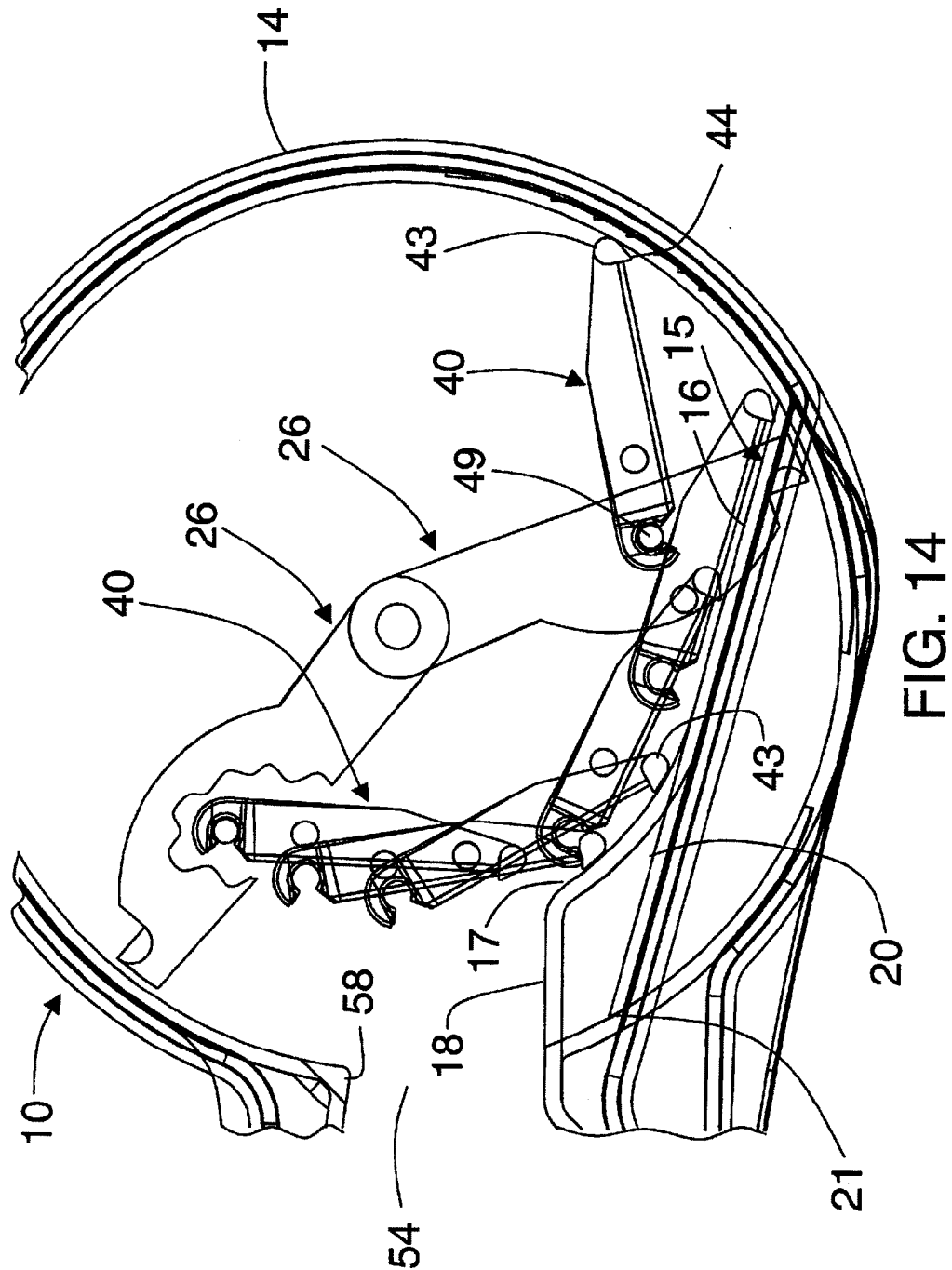
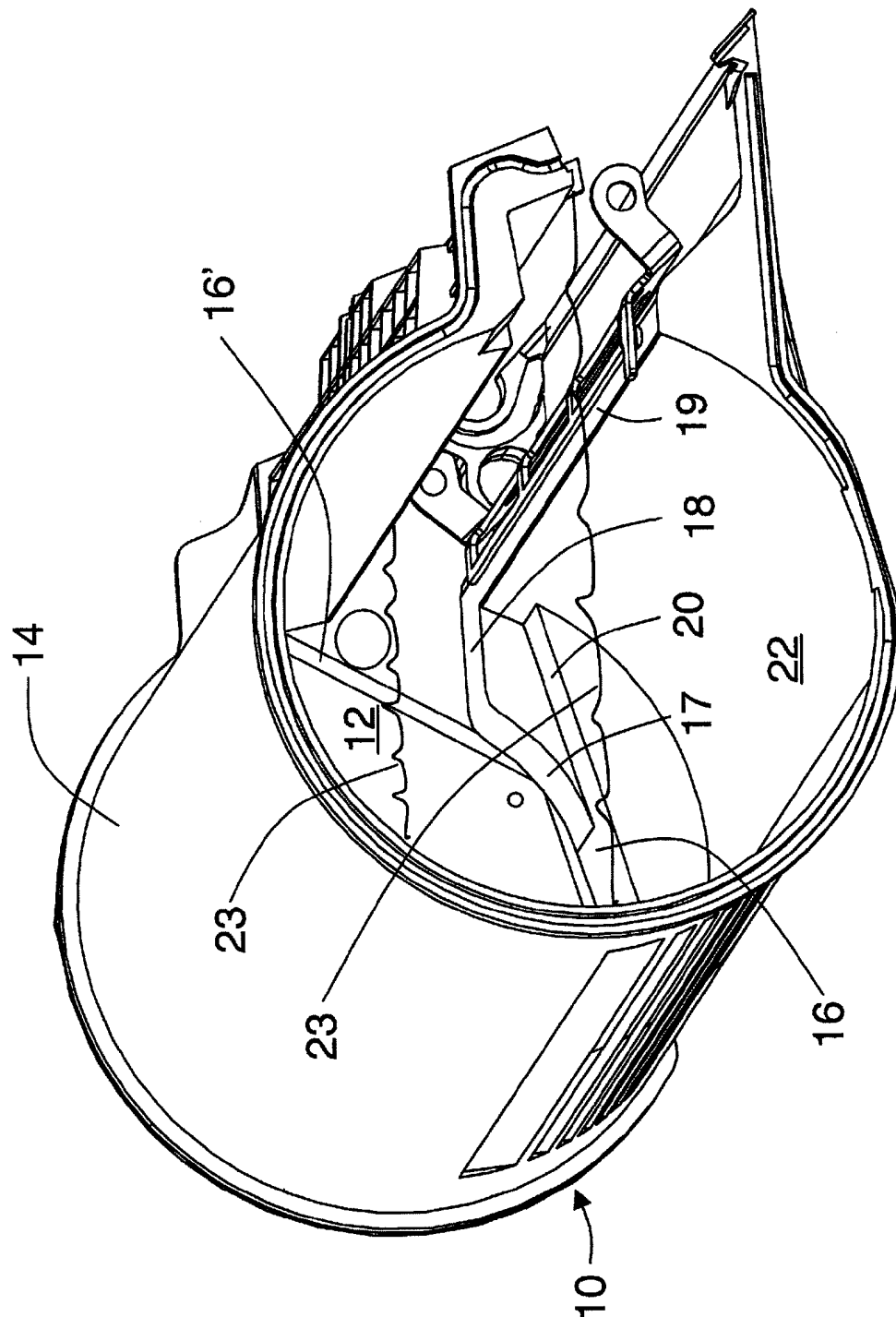


FIG. 14





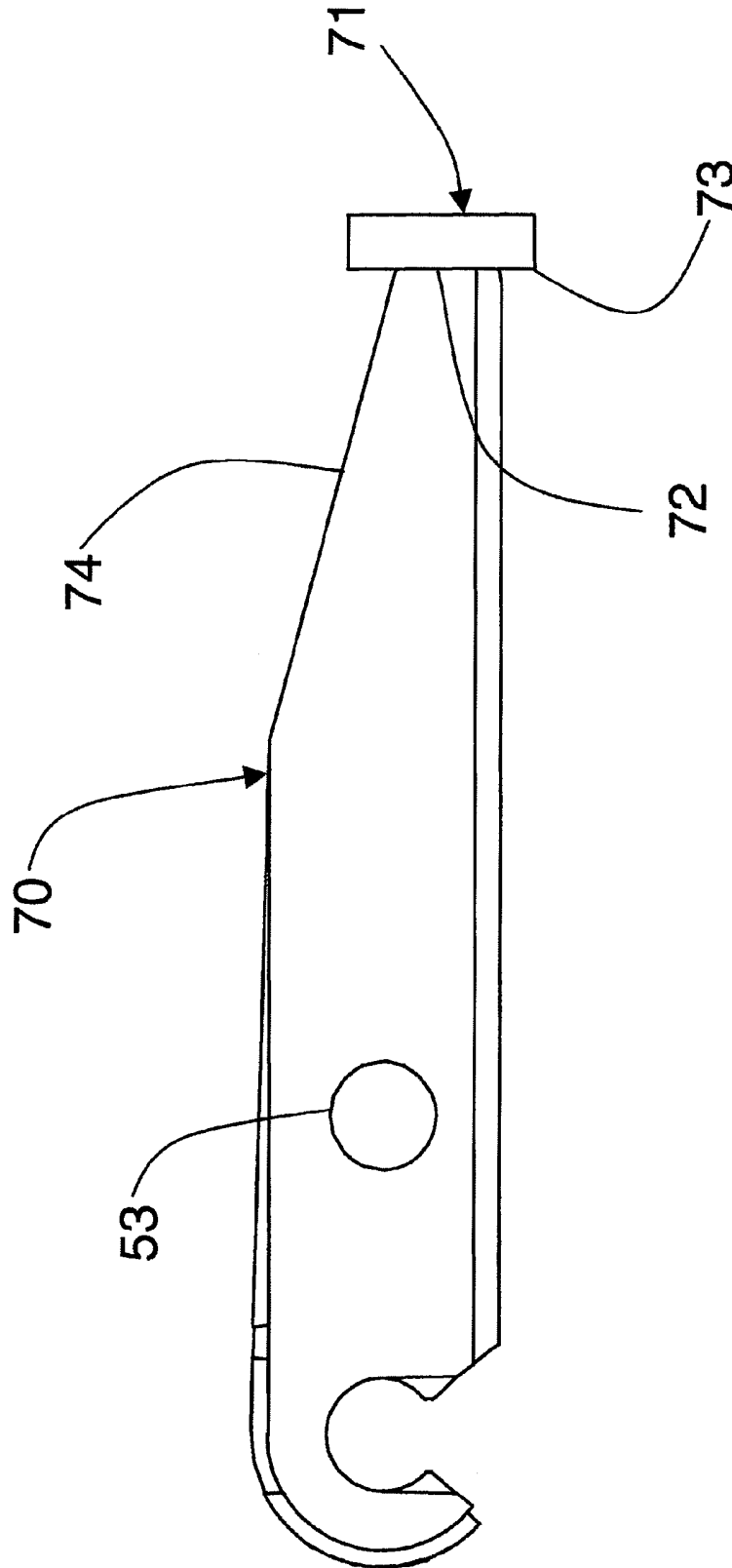


FIG. 16

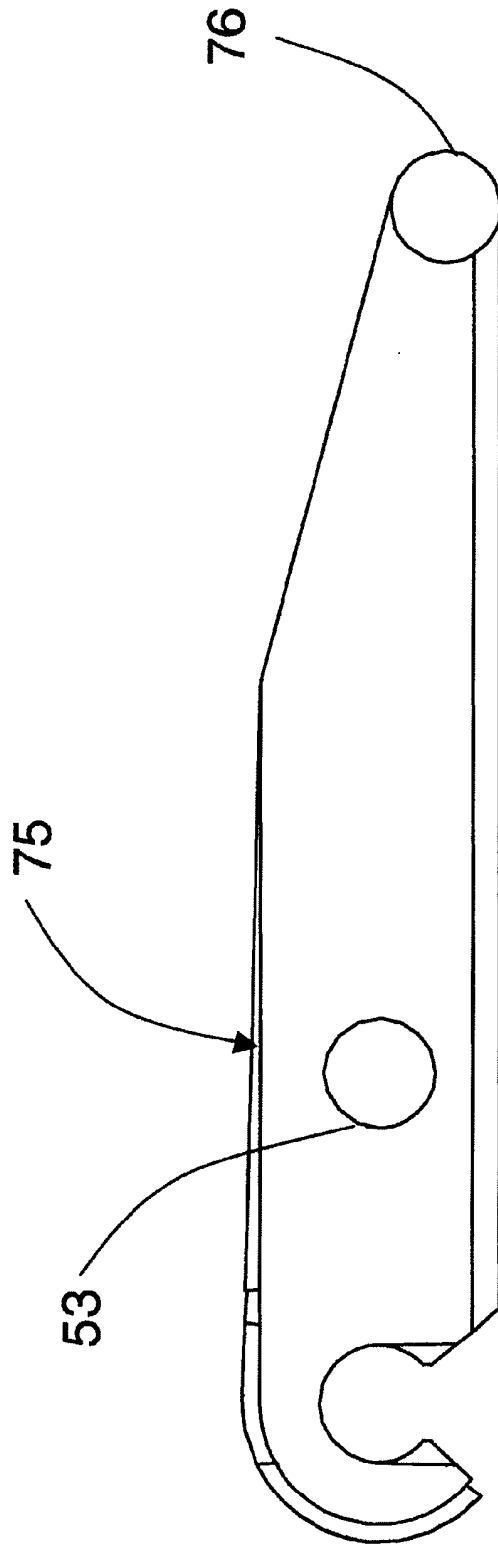


FIG. 17

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**TONER CARTRIDGE****FIELD OF THE INVENTION**

This invention relates to an improved toner cartridge for use in a laser printer and, more particularly, to a toner cartridge for use in a laser printer in which more of the toner is effectively utilized with an additional paddle for moving toner not moved by a main or first paddle.

**BACKGROUND OF THE INVENTION**

It has previously been suggested in U.S. Pat. No. 5,875,378 to Campbell et al, which is incorporated by reference herein, to use a single paddle to sweep a hopper or toner reservoir in a toner cartridge of a laser printer to agitate the toner therein and produce more effective utilization thereof.

Because of the internal geometry of the toner reservoir or hopper of the toner cartridge in the aforesaid Campbell et al patent, the single paddle of the aforesaid Campbell et al patent is incapable of reaching all volumes of the toner reservoir or hopper. This is because a portion of the hopper or toner reservoir has a non-circular portion, which results in a smaller cross section of the hopper or toner reservoir, in its bottom adjacent one of its end walls.

As a result, a significant amount of toner is not used at the end of the life of a toner cartridge. Some of this unused toner can be utilized through a user shaking the toner cartridge after removing it from the laser printer and then returning the toner cartridge to the laser printer after shaking.

The toner moving paddle in the aforesaid Campbell et al patent has been constructed so that its outer toner moving bar avoids sweeping the non-circular portion of the hopper or toner reservoir. The non-circular portion constitutes an inset in the inner surface of the toner reservoir or hopper wall to provide increased space exterior of the toner reservoir or hopper for rollers in the laser printer for feeding each sheet of a medium for printing.

Additionally, it has previously been suggested in U.S. Pat. No. 5,634,169 to Barry et al, which is incorporated by reference herein, to use a toner level sensing system in a toner cartridge of the type shown and described in the aforesaid Campbell et al patent. This toner level sensing system senses the level of the toner in the toner cartridge by sensing the torque created by the toner on the moving paddle because the torque on the moving paddle is reduced as the toner level decreases. Thus, any structure producing an additional torque on the toner moving paddle during each revolution of the toner moving paddle would render the toner level sensing system ineffective, particularly at relatively low levels of toner in the toner cartridge.

Furthermore, an improved toner, insofar as reducing the required fuser temperature, has substantially worse powder flow and angle of repose properties than the prior toner. These properties increase the propensity of the improved toner to cling to portions of the hopper or toner reservoir that are not reached by the single paddle of the aforesaid Campbell et al patent. This also affects the ability to deliver toner to a developer roll of the laser printer.

The improved toner is monocomponent, which can become stagnant and cohesive when left undisturbed for a period of time. This stagnation and settling of the toner may be aggravated by the slight vibrations generated by the printer motor and gear train in a laser printer.

**SUMMARY OF THE INVENTION**

The toner cartridge of the present invention utilizes a second paddle in conjunction with the first paddle to sweep

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most of the volume that the first paddle has been incapable of sweeping. Therefore, more of the toner is swept by the combined paddles of the present invention than by the single paddle in the aforesaid Campbell et al patent so that more toner is available for use.

The present invention has the second paddle pivotally supported on the first paddle, which revolves about a fixed first axis, so that the second paddle pivots about a second axis substantially parallel to the fixed first axis about which the first paddle revolves. Thus, sweeping of almost all of the volume of the toner reservoir is accomplished with the two paddles of the present invention.

The second paddle also engages a portion of the longitudinal wall of the toner reservoir to remove more of the toner therefrom than is accomplished with the first paddle. The first paddle has a slight clearance with respect to all of the walls of the toner reservoir.

The toner level sensing system of the aforesaid Barry et al patent is not affected by the use of the second paddle. This is because the toner level sensing system senses the torque when the first paddle is at substantially its lowermost position and the second paddle trails the first paddle so that it is not creating any significant torque when the torque on the first paddle is sensed by the toner level sensing system.

The use of the second paddle reduces the need for a user to shake the toner cartridge to obtain the use of more toner in the toner cartridge. This is because most of the toner, which could be dislodged by shaking, had already been removed by the second paddle.

This invention relates to a toner cartridge comprising a toner reservoir having toner therein and a first paddle rotatable in the toner reservoir about a fixed first axis. The toner reservoir has a first portion in which the toner therein is engaged by the first paddle to agitate the toner and to push the toner out of the toner reservoir during each revolution of the first paddle. A second paddle is pivotally supported on the first paddle for pivotal movement about a second axis substantially parallel to the fixed first axis in response to each revolution of the first paddle about the fixed first axis. The toner reservoir has a second portion in which the toner therein is not engaged by the first paddle during each revolution of said first paddle about the fixed first axis. The second paddle includes a toner moving element for moving through the second portion of the toner reservoir in response to each revolution of the first paddle through the toner reservoir to engage the toner in the second portion of the toner reservoir to agitate the toner and to push the toner out of the toner reservoir during each revolution of the first paddle.

An object of this invention is to provide a toner cartridge for a laser printer to permit agitation of a larger volume of the toner within the hopper or toner reservoir of the toner cartridge.

Other objects of this invention will be readily perceived from the following description, claims, and drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The attached drawings illustrate preferred embodiments of the invention, in which:

FIG. 1 is a partial cut-away perspective view of a portion of a toner cartridge of a laser printer taken from its left side where left is determined facing a laser printer from its front side in which insertion of the toner cartridge is made with the toner cartridge having a first or main paddle for pivotally supporting a second or auxiliary paddle of the present invention;

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FIG. 2 is a perspective view of a preferred embodiment of the second paddle pivotally supported on the first paddle taken from the left rear and showing the second paddle in a different position from that in FIG. 1;

FIG. 3 is a perspective view taken from the left front and showing the second paddle in a position in which it engages a wall of the cartridge during its movement with the first paddle;

FIG. 4 is an enlarged side elevational view of a preferred embodiment of the second paddle of the present invention;

FIG. 5 is a left side elevational view of the toner cartridge with its left end wall removed along with a portion of an inset adjacent the removed left end wall and showing the second paddle making initial contact with a curved longitudinal wall of the toner cartridge and the position of the second paddle relative to the first paddle;

FIG. 6 is a right side elevational view of the toner cartridge with both end walls removed along with a portion of an inset adjacent the removed left end wall omitted for clarity purposes and showing the second paddle in a position in which it engages a wall of the cartridge during its movement with the first paddle;

FIG. 7 is a right side elevational view, similar to FIG. 6, with both end walls removed along with a portion of an inset adjacent the removed left end wall omitted for clarity purposes and showing additional structure of the toner cartridge;

FIG. 8 is an enlarged perspective view of the preferred embodiment of the second paddle;

FIG. 9 is an enlarged perspective view of the second paddle of FIG. 8;

FIG. 10 is an enlarged side elevational view of another embodiment of the second paddle;

FIG. 11 is an enlarged side elevational view of a further modification of the second paddle of the present invention;

FIG. 12 is a schematic perspective view of unswept volumes of toner in the toner cartridge by the first and second paddles;

FIG. 13 is a schematic perspective view of unswept volumes of toner in the toner cartridge by only the first paddle;

FIG. 14 is an enlarged fragmentary left side elevational view, similar to FIG. 5, with both end walls removed along with a portion of an inset adjacent the removed left end wall and showing various positions of the second paddle relative to the first paddle in the interior of the toner reservoir during a portion of a revolution of the first paddle;

FIG. 15 is a right front perspective view of the toner cartridge with an end wall removed.

FIG. 16 is an enlarged side elevational view of still another embodiment of the second paddle; and

FIG. 17 is an enlarged side elevational view of a further modification of the second paddle.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings and particularly FIG. 1, there is shown a toner cartridge 10 for use in a laser printer. The positioning of the toner cartridge 10 in a laser printer is particularly shown and described in the aforesaid Campbell et al patent. U.S. Pat. No. 6,181,904 B1 to Burdette et al, which is incorporated by reference herein, also discloses a toner cartridge.

The toner cartridge 10 includes a right end wall 11 (see FIG. 5) and a left end wall 12 (see FIG. 15) with each having

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a circular shape of the same radius. As more particularly shown and described in the aforesaid Campbell et al patent, a longitudinal wall 14 extends between the end walls 11 (see FIG. 5) and 12 (see FIG. 15). As more particularly shown and described in the aforesaid Campbell et al patent, the longitudinal wall 14 (see FIG. 5) is curved for slightly less than 360° with its curved shape having the same radius as the circular shape of each of the end walls 11 and 12 (see FIG. 15).

As more particularly shown and described in the aforesaid Campbell et al patent, the longitudinal wall 14 (see FIG. 1) has an inset 15 at its left end. The inset 15 includes an inclined flat surface 16, which extends inwardly from the left end wall 12 (see FIG. 15) and is integral with the left end wall 12 and the longitudinal wall 14 as shown in FIG. 5.

An outer portion of the inclined flat surface 16 of the inset 15 has an inclined surface 16' (see FIG. 15) extending upwardly therefrom and integral with the left end wall 12. A middle portion of the inclined flat surface 16 (see FIG. 5) has a rising curved portion 17 terminate in an inclined flat surface 18 of a rear wall 19 (see FIG. 15) as more particularly shown and described in the aforesaid Campbell et al patent. An innermost portion of the inclined flat surface 16 (see FIG. 5) continues as a straight flat surface 20 until it engages a curved portion of the longitudinal wall 14 as indicated at 21.

As more particularly shown and described in the aforesaid Campbell et al patent, the right end wall 11, the left end wall 12 (see FIG. 15), and the longitudinal wall 14 define a toner reservoir or hopper 22. Toner, which has its level indicated in FIG. 15 by surface lines 23, is retained in the hopper or toner reservoir 22.

A first or main paddle 26 (see FIG. 2) is rotatably supported by the end walls 11 (see FIG. 5) and 12 (see FIG. 15) in the manner shown and described in the aforesaid Campbell et al patent. The first paddle 26 (see FIG. 2) includes a shaft 27, which extends through the left end wall 12 (see FIG. 15), to be driven preferably in the manner shown and described in the aforesaid Campbell et al patent.

The first paddle 26 (see FIG. 2) includes an outer toner moving bar 28, which extends across most of the axial length of the hopper 22 (see FIG. 1) where the cross section is substantially constant and not reduced by the inset 15. The outer toner moving bar 28 (see FIG. 2) is supported at the end of each of a plurality of support struts 29 extending from a central portion 30, which has a substantially cross configuration, of the shaft 27.

The outer toner moving bar 28 has a slight clearance with the inner surface of the longitudinal wall 14 (see FIG. 1) during rotation of the first paddle 26 about a fixed axis. As a result, the first paddle 26 sweeps across the hopper or toner reservoir 22 but leaves unswept volumes of toner therein as shown in FIG. 13 including volumes away from the inner surface of the longitudinal wall 14 (see FIG. 1). The unswept volumes of FIG. 13 are those in which the toner remains after each revolution of the first paddle 26 (see FIG. 3).

The first paddle 26 has an additional support strut 31 forming part of a hollow rectangular shaped portion 32 on its left end. The hollow rectangular shaped portion 32 does not extend as far from the axis of the shaft 27 as the outer toner moving bar 28 because of the reduced inner surface of the toner reservoir or hopper 22 (see FIG. 1) due to the presence of the inset 15. However, the hollow rectangular shaped portion 32 (see FIG. 3) of the first paddle 26 can sweep some toner off the semicircular lower portion of the left end wall 12 (see FIG. 15). This leaves an unswept volume 33 (see



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FIG. 13) because there is clearance of the first paddle 26 with any inner surface of the toner cartridge 10 (see FIG. 1).

Thus, FIG. 13 discloses unswept volumes left by the first paddle 26 (see FIG. 2). The unswept volumes in FIG. 13 also are indicative of where the toner is removed in the toner reservoir or hopper 22 (see FIG. 1) by the first paddle 26 (see FIG. 2).

Accordingly, a second paddle 40 is pivotally mounted on the first paddle 26 so that it can pivot about an axis, which is parallel to the fixed axis about which the shaft 27 of the first paddle 26 rotates. As shown in FIG. 8, the second paddle 40 has a pair of substantially parallel support arms 41 and 42 having an outer toner moving bar 43 attached thereto at one end of each of the support arms 41 and 42.

In the preferred embodiment, the outer toner moving bar 43 has a tear drop cross section as shown in FIG. 4. The tear drop cross section includes a substantially sharp end edge 44, which dives into the toner initially for agitating the toner as the second paddle 40 pivots relative to the first paddle 26 (see FIG. 2). A toner engaging surface 45 (see FIG. 4) of the outer toner moving bar 43 extends away from the sharp end edge 44 and engages the toner as the second paddle 40 is advanced through the toner during each revolution of the first paddle 26 (see FIG. 2).

It should be understood that the substantially sharp end edge 44 (see FIG. 4) has a slight radius at its end. This is due to manufacturing requirements. For example, the slight radius is 0.2 mm while the substantially straight portion of the toner engaging surface 45 is 2.4 mm long.

Each of the support arms 41 (see FIG. 9) and 42 has a cutout or slot 46 and 47, respectively, in its end remote from the outer toner moving bar 43. In the preferred embodiment, the cutout 46 in the support arm 41 receives a larger portion 48 (see FIG. 2) of a stepped pivot shaft 49. A smaller portion 50 of the stepped pivot shaft 49 is received in the cutout 47 (see FIG. 8) in the support arm 42.

This use of the stepped pivot shaft 49 (see FIG. 2) insures the correct installation of the second paddle 40 on the first paddle 26. Without the need to insure correct installation, the stepped pivot shaft 49 could have a constant diameter.

The stepped pivot shaft 49 extends between the support strut 29, which is adjacent the second paddle 40, and the additional support strut 31. The adjacent support strut 29 supports one end of the outer toner moving bar 28 of the first paddle 26. As previously mentioned, the additional support strut 31 supports the hollow rectangular shaped portion 32 on the first paddle 26.

The lengths of the support arms 41 and 42 insure that the second paddle 40 trails the first paddle 26 during each revolution of the first paddle 26. That is, the support arms 41 and 42 create an effective radius greater than the radius of the inner surface of the longitudinal wall 14 (see FIG. 1) so that the second paddle 40 always trails the first paddle 26.

A stop pin 53 (see FIG. 8) is supported by the support arms 41 and 42 of the second paddle 40 and extends beyond each of the support arms 41 and 42. The extending ends of the stop pin 53 engage the adjacent support strut 29 (see FIG. 2) and the additional support strut 31 of the first paddle 26 to control when the second paddle 40 flips over the top during each revolution of the first paddle 26 to have the outer toner moving bar 43 of the second paddle 40 engage the longitudinal wall 14 (see FIG. 1). The stop pin 53 (see FIG. 2) also maintains the orientation of the second paddle 40 relative to the first paddle 26 and the relation of the outer toner moving bar 43 to the inset 15 (see FIG. 5).

The outer toner moving bar 43 (see FIG. 8) of the second paddle 40 extends outwardly beyond the outer side of the

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support arm 42. This enables the outer toner moving bar 43 to almost abut the left end wall 12 (see FIG. 15) and have its end in substantially the same plane as the outer surface of the hollow rectangular shaped portion 32 (see FIG. 3) of the first paddle 26.

During each revolution of the first paddle 26, the outer toner moving bar 43 (see FIG. 8) of the second paddle 40 initially engages the inner surface of the longitudinal wall 14 at the position shown in FIG. 5. The continued clockwise pivotal movement of the outer toner moving bar 43 about the axis of the stepped shaft 49 (see FIG. 2) in response to clockwise rotation of the first paddle 26 ceases to be effective after the outer toner moving bar 43 leaves the rising curved portion 17 (see FIG. 14) of the inset 15.

In the same manner as described in the aforesaid Campbell et al patent for the movement of the toner out of the hopper or toner reservoir 22 (see FIG. 1) by the first paddle 26, the second paddle 40 also moves the toner in the same manner out of the hopper 22. Thus, the toner is pushed over the rear wall 19 (see FIG. 15).

As described in the aforesaid Campbell et al patent, the toner is pushed over the rear wall 19 (see FIG. 15) through an exit port or opening 54 (see FIG. 5) to a toner adder roll 55 and then to a developer roll 56 for application to a photoconductive drum 57 (see FIG. 7) of the laser printer as particularly shown and described in the aforesaid Campbell et al and Burdette et al patents. As shown in FIG. 5, the exit port or opening 54 is defined by a terminal end 58 of the circular shape of the longitudinal wall 14 and the flat surface 18 of the rear wall 19 (see FIG. 15).

The second paddle 40 (see FIG. 4) has the preferred embodiment of the cross section of the outer toner moving bar 43. A second paddle 60 (see FIG. 10) is the same as the second paddle 40 (see FIG. 4) except that the second paddle 60 (see FIG. 10) has an outer toner moving bar 61 of a rectangular cross section. The outer toner moving bar 61 includes a sharp end edge 62 and a toner engaging surface 63.

FIG. 11 discloses a second paddle 65 having its outer toner moving bar 66 of the same rectangular cross section as the outer toner moving bar 61 (see FIG. 10) of the second paddle 60. However, the outer toner moving bar 66 (see FIG. 11) has its toner engaging surface 67 extending from its sharp end edge 68 for a much shorter distance.

FIG. 16 shows a second paddle 70 having its outer toner moving bar 71 of the same rectangular cross section as the outer toner moving bar 66 (see FIG. 11) of the second paddle 65 and the outer toner moving bar 61 (see FIG. 10) of the second paddle 60. However, the outer toner moving bar 71 (see FIG. 16) has its toner engaging surface 72 extending from its sharp end edge 73 substantially perpendicular to the bottom edge of each of its support arms 74 (one shown).

FIG. 17 discloses a second paddle 75 having an outer toner moving bar 76 of circular cross section. There is no substantially sharp end edge in this embodiment.

The outer toner moving bar 44 (see FIG. 8) of the second paddle 40 is significantly better in delivering toner than the circular outer toner moving bar 76 (see FIG. 17) of the second paddle 75. The outer toner moving bar 44 (see FIG. 8) of the second paddle 40 is better in delivering toner than the outer toner moving bar 71 (see FIG. 16) of the second paddle 70.

When comparing FIGS. 12 and 13, the second paddle 40 (see FIG. 4) sweeps a volume of toner identified as A in FIG. 13 and most of the volume of toner identified as B. As shown in FIG. 12, the volumes A and B of FIG. 13 have been

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removed by the second paddle 40 (see FIG. 4) except for two volumes C and D also not swept by the second paddle 40 (see FIG. 8). This is because the rising curved portion 17 (see FIG. 1) of the inset 15 prevents the outer toner moving bar 43 of the second paddle 40, for example, from engaging either the inclined surface 16' (see FIG. 15) adjacent the left end wall 12 or the straight flat surface 20 of the inclined flat surface 16. It does this because the rising curved portion 17 extends further into the toner reservoir or hopper 22 (see FIG. 15).

An advantage of this invention is that there is less undeliverable toner within a toner cartridge for use in a laser printer. Another advantage of this invention is that it agitates a larger volume of toner within a toner cartridge for use in a laser printer. A further advantage of this invention is that there is no offset torque to degrade a torque based toner level sensing system.

For purposes of exemplification, preferred embodiments of the invention have been shown and described according to the best present understanding thereof. However, it will be apparent that changes and modifications in the arrangement and construction of the parts thereof may be resorted to without departing from the spirit and scope of the invention.

What is claimed is:

1. A toner cartridge comprising:

a toner reservoir having toner therein;

a first paddle rotatable in said toner reservoir about a fixed first axis;

said toner reservoir having a first portion in which the toner therein is engaged by said first paddle to agitate the toner and to push the toner out of said toner reservoir during each revolution of said first paddle;

a second paddle pivotally supported on said first paddle for pivotal movement about a second axis substantially parallel to the fixed first axis in response to each revolution of said first paddle about the fixed first axis;

said toner reservoir having a second portion in which the toner therein is not engaged by said first paddle during each revolution of said first paddle about the fixed first axis;

and said second paddle including a toner moving element for moving through said second portion of said toner reservoir in response to each revolution of said first paddle through said toner reservoir to engage the toner in said second portion of said toner reservoir to agitate the toner and to push the toner out of said toner reservoir during each revolution of said first paddle.

2. The toner cartridge according to claim 1 in which said toner moving element of said second paddle has a substantially sharp end edge for initially engaging the toner in said second portion of said toner reservoir to agitate the toner.

3. The toner cartridge according to claim 2 in which said toner moving element of said second paddle has a toner engaging surface extending from said substantially sharp end edge of said second paddle to engage the toner in said toner reservoir after said substantially sharp end edge has engaged the toner in said toner reservoir and to push the toner out of said toner reservoir.

4. The toner cartridge according to claim 3 in which said toner moving element of said second paddle has a tear drop cross section defining said substantially sharp end edge and said toner engaging surface.

5. The toner cartridge according to claim 4 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

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6. The toner cartridge according to claim 3 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

7. The toner cartridge according to claim 2 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

8. The toner cartridge according to claim 1 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

9. The toner cartridge according to claim 1 in which said toner moving element of said second paddle continues to agitate the toner and push the toner out of said second portion of said toner reservoir after said first paddle ceases to push the toner out of said first portion of said toner reservoir during each revolution of said first paddle.

10. A toner cartridge comprising:

a toner reservoir having toner therein

a first paddle rotatable in said toner reservoir about a fixed first axis;

said toner reservoir having a first portion in which the toner therein is engaged by said first paddle to agitate the toner and to push the toner out of said toner reservoir during each revolution of said first paddle;

a second paddle pivotally supported by said first paddle for pivotal movement about a second axis substantially parallel to the fixed first axis in response to each revolution of said first paddle about the fixed first axis;

said toner reservoir having a second portion in which the toner therein is not engaged by said first paddle during each revolution of said first paddle about the fixed first axis;

said second paddle having a toner moving element for moving through said second portion of said toner reservoir in response to each revolution of said first paddle through said toner reservoir to engage the toner in said second portion of said toner reservoir to agitate the toner and to push the toner out of said toner reservoir during each revolution of said first paddle;

said first paddle having a first toner moving element for engaging only the toner in said first portion of said toner reservoir;

said toner reservoir having a third portion adjacent said second portion and remote from said first portion;

said first paddle having a second toner moving element for engaging only the toner in said third portion of said toner reservoir during each revolution of said first paddle about the fixed first axis;

and said toner moving element of said second paddle also simultaneously moving through said third portion of said toner reservoir in response to each revolution of said first paddle through said toner reservoir to engage the toner in said third portion of said toner reservoir to agitate the toner and to push the toner out of said toner reservoir during each revolution of said first paddle.

11. The toner cartridge according to claim 10 in which said toner moving element of said second paddle has a substantially sharp end edge for initially engaging the toner in each of said second and third portions of said toner reservoir to agitate the toner.

12. The toner cartridge according to claim 11 in which said toner moving element of said second paddle has a toner engaging surface extending from said substantially sharp



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end edge of said second paddle to engage the toner in each of said second and third portions of said toner reservoir after said substantially sharp end edge has engaged the toner in each of said second and third portions of said toner reservoir.

13. The toner cartridge according to claim 12 in which said toner moving element of said second paddle has a tear drop shape defining said substantially sharp end edge and said toner engaging surface.

14. The toner cartridge according to claim 13 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

15. The toner cartridge according to claim 12 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

16. The toner cartridge according to claim 11 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

17. The toner cartridge according to claim 10 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

18. A toner cartridge comprising:

a toner reservoir having toner therein;

said toner reservoir including a plurality of walls;

said plurality of walls including:

a pair of substantially parallel end walls;

and a longitudinal wall extending between said end walls and joined to each of said end walls;

each of said end walls having a circular shape of the same radius;

said longitudinal wall including:

a first portion having a curved shape extending longitudinally from one of said end walls toward the other of said end walls, said curved shape of said first portion having the same radius as the circular shape of each of said end walls but terminating prior to completion of the circular shape of each of said end walls;

a second portion extending from said first portion toward the other of said end walls;

and a third portion extending from said second portion to the other of said end walls;

said first portion of said longitudinal wall having a substantially greater length than said second portion of said longitudinal wall;

said second portion of said longitudinal wall having a substantially greater length than said third portion of said longitudinal wall;

a first paddle rotatable in said toner reservoir about a fixed first axis, said first paddle being rotatably supported by said end walls;

said first paddle having a clearance from each of said end walls and said longitudinal wall during rotation of said first paddle through said toner reservoir;

a second paddle pivotally supported on said first paddle for pivotal movement about a second axis substantially parallel to the fixed first axis in response to rotation of said first paddle about the fixed first axis;

each of said second portion and said third portion of said longitudinal wall including:

a curved portion having the same shape as said curved shape of said first portion of said longitudinal wall but of less circumference;

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and a non-curved portion closer to the fixed first axis than said curved portion of each of said second portion and said third portion of said longitudinal wall;

said curved portion of each of said second portion and said third portion of said longitudinal wall having the same radius as the circular shape of each of said end walls;

said longitudinal wall having an exit port formed therein;

said second paddle having a toner moving element for moving through said toner reservoir having said second and third portions of said longitudinal wall, said toner moving element of said second paddle engaging said second and third portions of said longitudinal wall of said toner reservoir to engage the toner therein to agitate and push the toner out of said toner reservoir through said exit port;

and said first paddle having a first toner moving element for engaging the toner in said toner reservoir along said first portion of said longitudinal wall of said toner reservoir during each revolution of said first paddle to agitate and push the toner out of said toner reservoir through said exit port.

19. The toner cartridge according to claim 18 including said first paddle having a second toner moving element for engaging the toner in said toner reservoir along said third portion of said longitudinal wall of said toner reservoir during each revolution of said first paddle to agitate and push the toner out of said toner reservoir through said exit port.

20. The toner cartridge according to claim 19 in which said first paddle includes:

a shaft rotatably supported in each of said end walls of said toner reservoir;

a plurality of substantially parallel support struts supporting said first toner moving element of said first paddle on said shaft;

and an additional support strut shorter than each of said plurality of support struts supporting said second toner moving element of said first paddle.

21. The toner cartridge according to claim 20 in which: said first paddle includes a pivot support extending between said additional support strut and said strut of said plurality of struts adjacent said second paddle;

and said second paddle includes:

a pair of substantially parallel support arms pivotally mounted on said pivot support of said first paddle;

an outer toner moving bar supported by said support arms and extending beyond said support arm closest to the adjacent of said end walls of said toner reservoir and constituting said toner moving element of said second paddle;

and a stop pin supported by said support arms closer to said pivot support than said outer toner moving bar and extending beyond the side of each of said support arms for engaging said additional support strut and the adjacent of said plurality of support struts of said first paddle to control when said second paddle flips into engagement with said second portion and said third portion of said longitudinal wall during each revolution of said first paddle through said toner reservoir.

22. The toner cartridge according to claim 18 in which said toner moving element of said second paddle has a substantially sharp end edge for initially engaging the toner in said second portion of said toner reservoir to agitate the toner.

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23. The toner cartridge according to claim 22 in which said toner moving element of said second paddle has a toner engaging surface extending from said substantially sharp end edge of said second paddle to engage the toner in said toner reservoir after said substantially sharp end edge has engaged the toner in said toner reservoir and to push the toner out of said toner reservoir.

24. The toner cartridge according to claim 23 in which said toner moving element of said second paddle has a tear drop cross section defining said substantially sharp end edge and said toner engaging surface.

25. The toner cartridge according to claim 24 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

26. The toner cartridge according to claim 18 including means for insuring that said second paddle trails said first paddle during each revolution of said first paddle through said toner reservoir.

27. The toner cartridge according to claim 18 in which said second paddle continues to agitate the toner and push the toner out of said toner reservoir after said first paddle ceases to be effective during a revolution of said first paddle.

28. An auxiliary paddle for use in a toner reservoir of a toner cartridge of a laser printer in cooperation with a main

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paddle revolving in the toner reservoir to aid in removing toner from a portion of the toner reservoir that the main paddle cannot remove the toner including:

a pair of substantially parallel support arms for pivotal support by the main paddle for pivotal movement relative to the main paddle during each revolution of the main paddle;

an outer toner moving bar for engaging the toner to be moved out of the toner reservoir;

said outer toner moving bar being supported by said support arms and extending beyond an outer side of one of said support arms to sweep a volume greater than the volume swept by the portion of said outer toner moving bar between said support arms;

and a stop pin supported by said support arms and extending beyond an outer side of each of said support arms for engaging the main paddle to control when said auxiliary paddle begins sweeping the volume in the toner reservoir during each revolution of the main paddle through the toner reservoir.

\* \* \* \* \*

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# THE UNITED STATES OF AMERICA

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December 31, 2009


THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
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U.S. PATENT: 6,487,383

ISSUE DATE: *November 26, 2002*

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
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P. SWAIN  
Certifying Officer

A4342

(12) **United States Patent**  
**Buchanan et al.**

(10) **Patent No.: US 6,487,383 B2**  
(45) **Date of Patent: Nov. 26, 2002**

(54) **DYNAMIC END-SEAL FOR TONER DEVELOPMENT UNIT**

(75) Inventors: **John Andrew Buchanan; Jarrett Clark Gayne; Jason Paul Hale; Benjamin Keith Newman; Tom E Stickler**, all of Lexington, KY (US)

(73) Assignee: **Lexmark International, Inc.**, Lexington, KY (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(51) **Int. Cl.<sup>7</sup> ..... G03G 15/08**

(52) **U.S. Cl. .... 399/103; 399/105**

(58) **Field of Search .... 399/102, 103, 399/105, 111**

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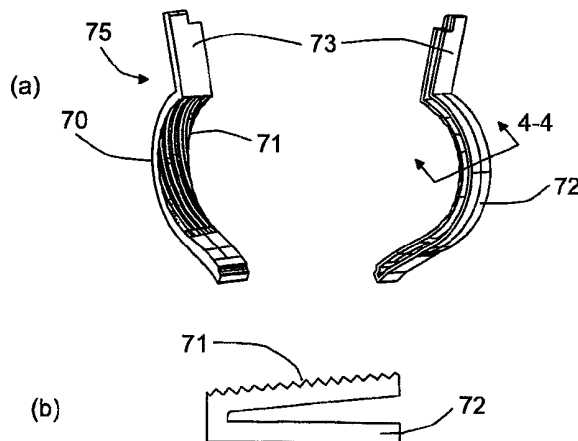
*Primary Examiner*—Hoang Ngo

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(57) **ABSTRACT**

An article used to seal the interface between the developer roll, doctor blade and developer housing in a laser printer toner cartridge is described. The sealing member described in the present application performs static sealing between the components while the cartridge is idle and performs dynamic sealing while the toner cartridge is used for printing, keeping the sealing surfaces free from toner by actively pushing the toner back into the developer sump. The seal has a rotary seal portion which seals between the frame of the cartridge and the developer roll, and a blade seal portion which seals between the frame of the cartridge and the doctor blade. The rotary seal portion is biased toward the surface of the developer roll and incorporates, on its face adjacent to the developer roll, ridges which act to push the toner away from the edge of the developer roll in use. The blade seal portion is biased toward the doctor blade.

**19 Claims, 7 Drawing Sheets**



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FIG. 1

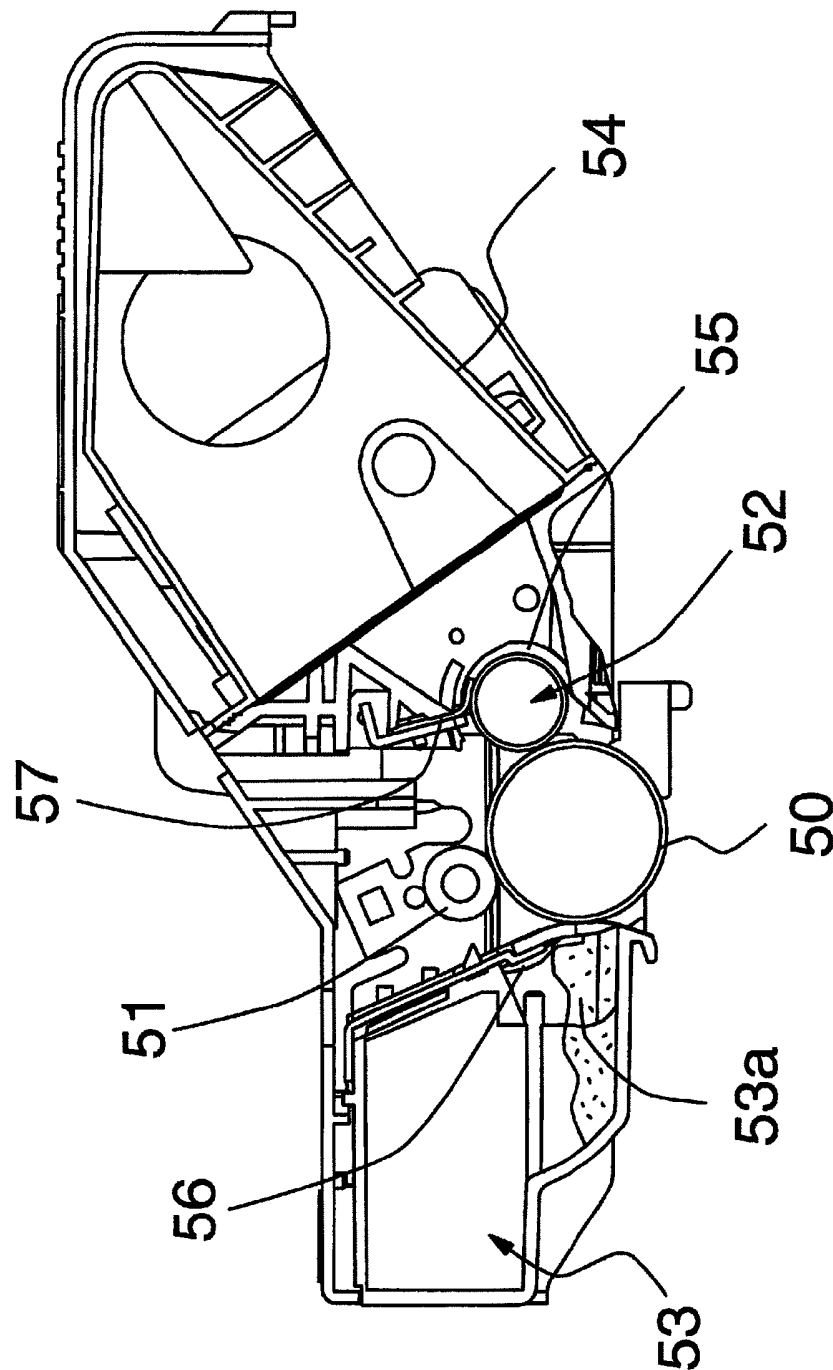




FIG. 2

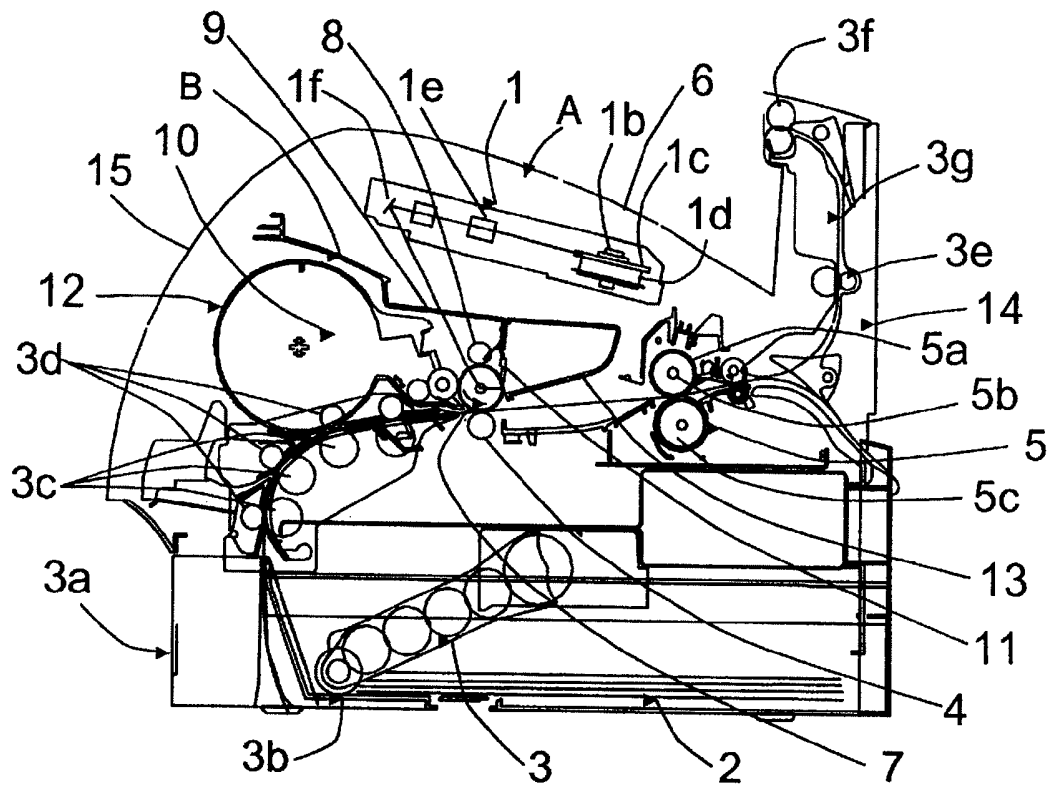


FIG. 3

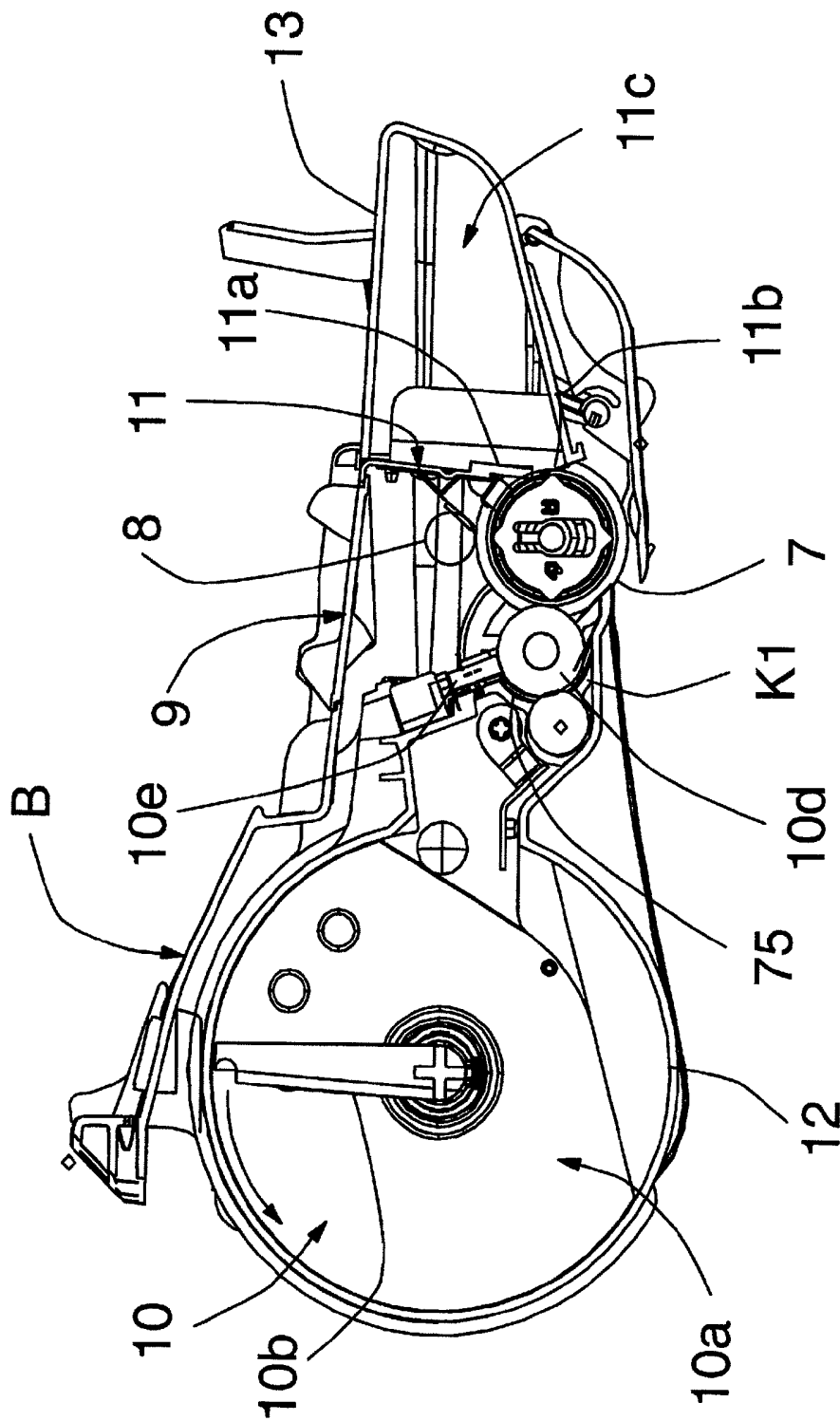


FIG. 4

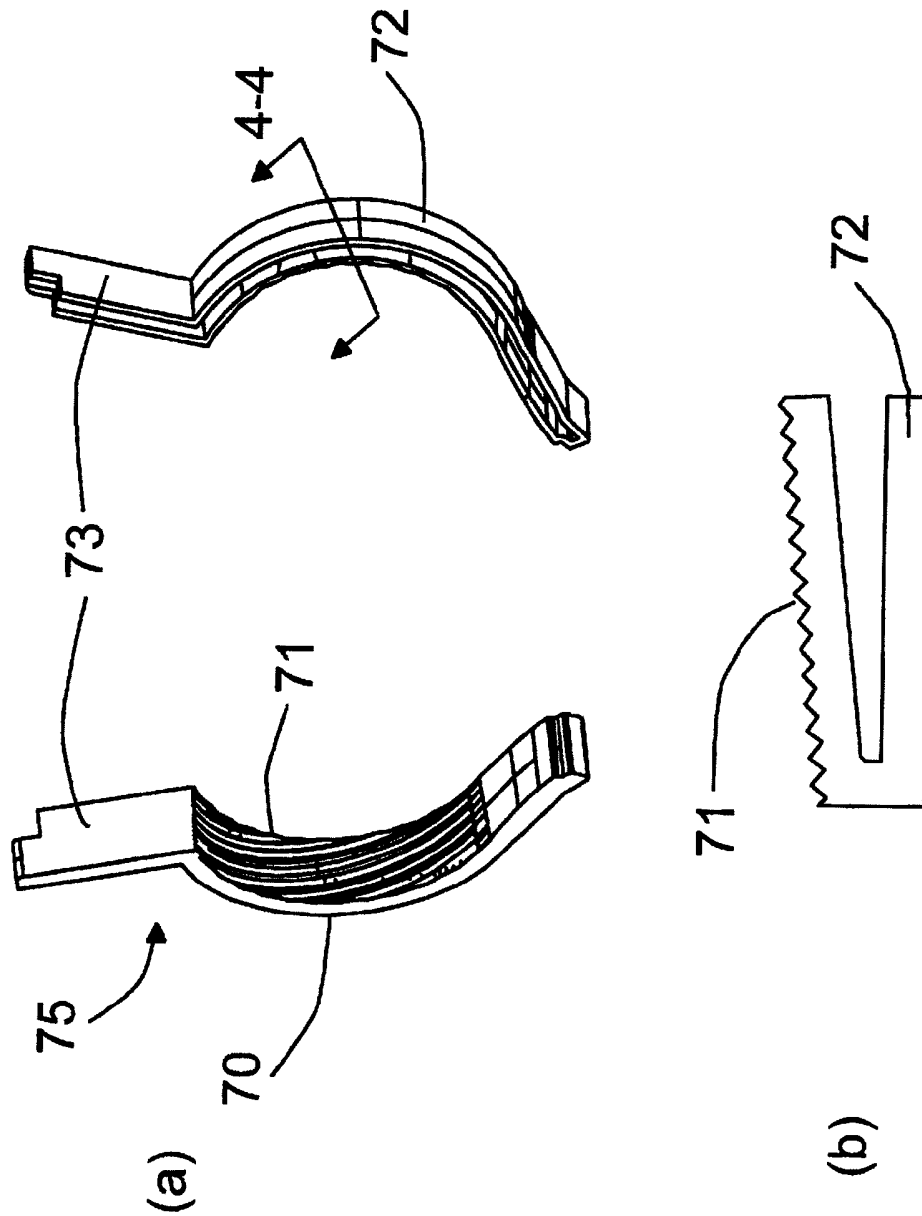


FIG. 5

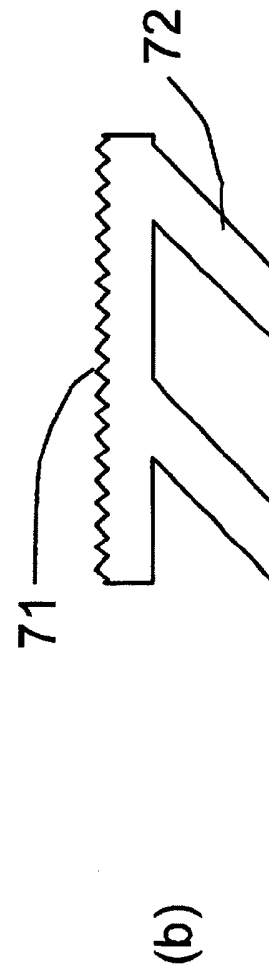
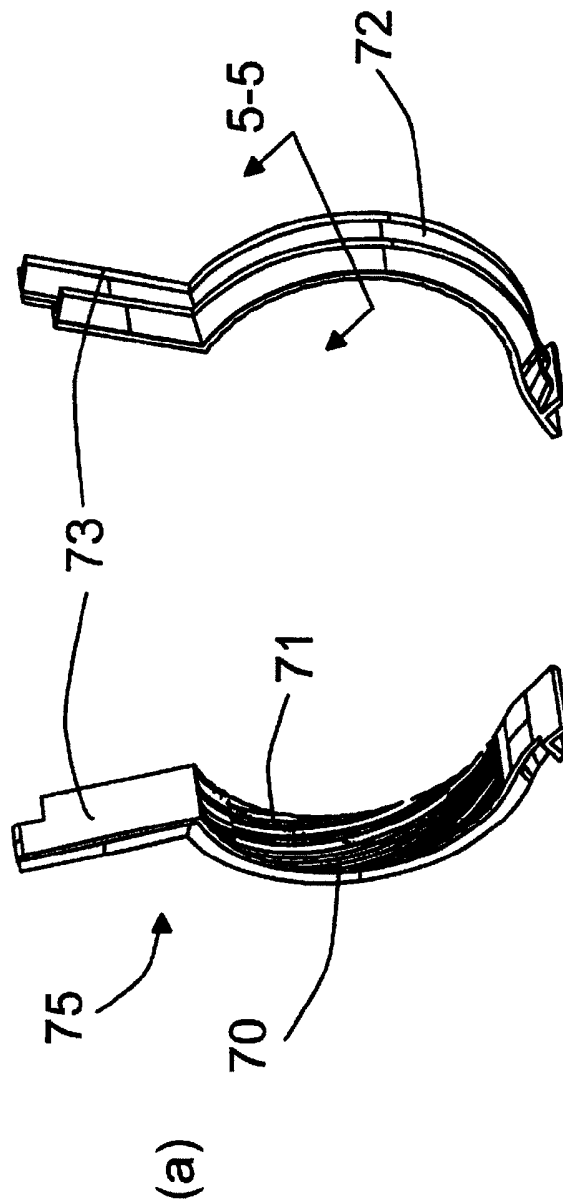


FIG. 6

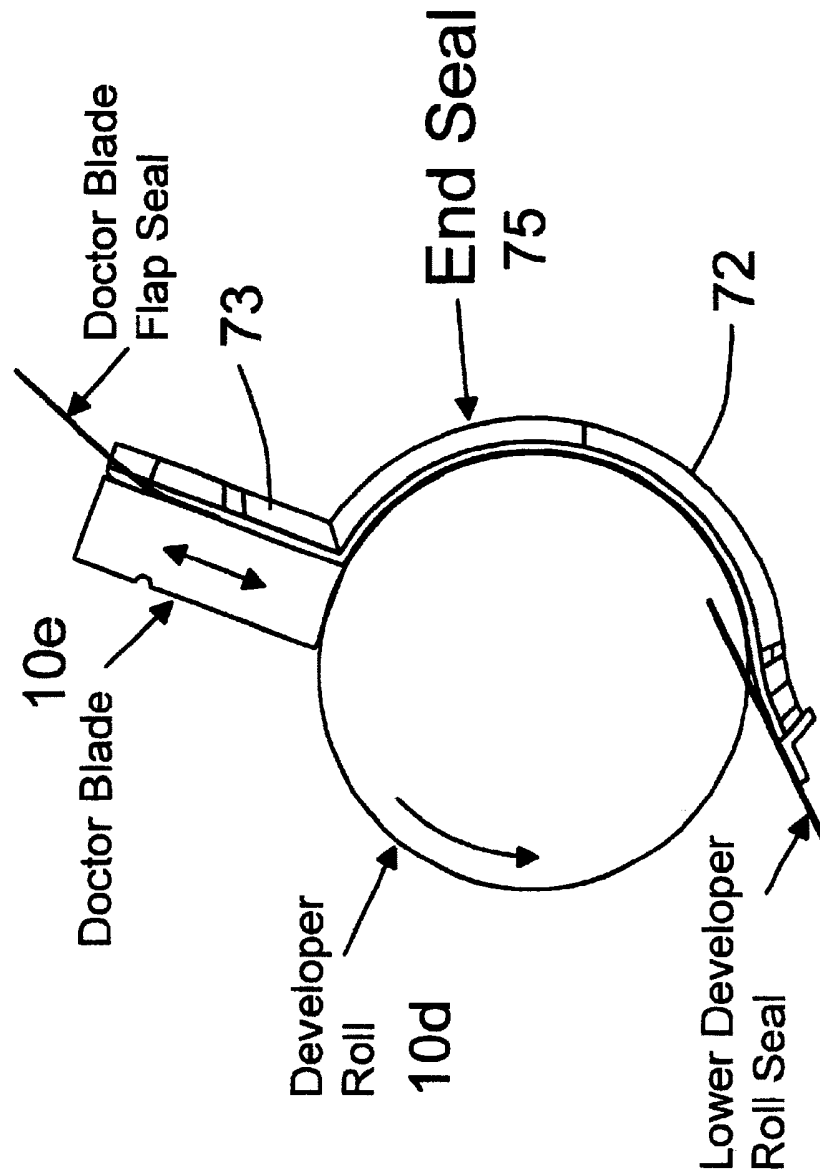
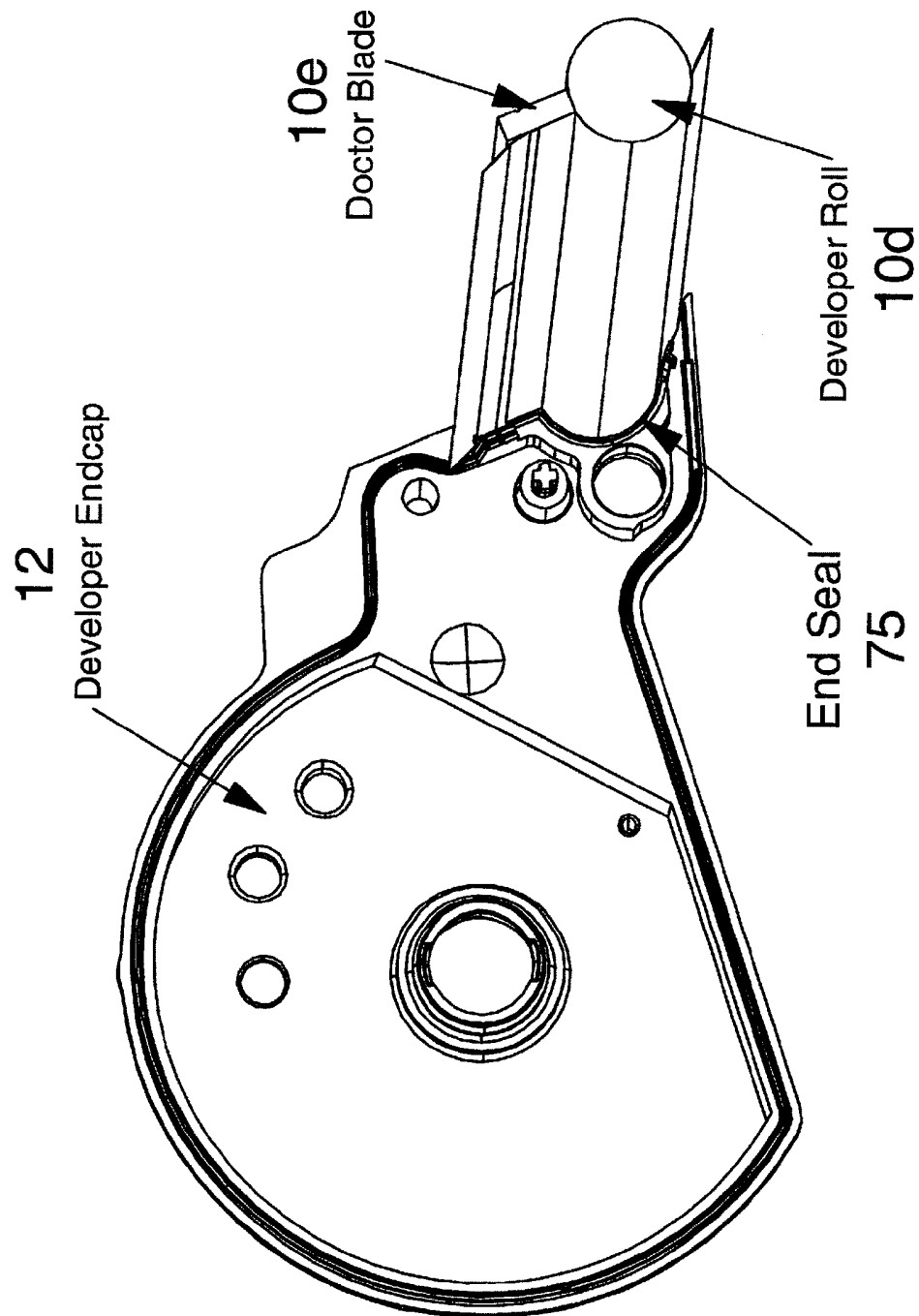


FIG. 7





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## DYNAMIC END-SEAL FOR TONER DEVELOPMENT UNIT

### TECHNICAL FIELD

The present invention relates to seals used in the electro-photographic printing process, particularly in laser printer toner cartridges. The seals prevent the leakage of materials, such as toner, from the cartridges.

### BACKGROUND OF THE INVENTION

In the electrophotographic printing process, an image-forming apparatus, such as a printer, performs selective exposures onto a uniformly charged image carrier to form a latent image. The latent image is made visible by toner, and the toner image is transferred to a recording medium so that the image may be rendered permanent. In such an apparatus, additional toner must be supplied each time it is used up. Not only is this operation for supplying toner inconvenient, but the operator's hands or clothing may become dirty if they come in contact with the toner. Also, the presence of the toner makes it necessary to periodically perform maintenance on each member of the apparatus. The result is leakage and spillage of toner that is best avoided in the electrophotographic printing apparatus.

FIG. 1 illustrates a conventional process cartridge in which supplying of toner and replacement of parts of an image carrier whose service life is finished are made possible when a user loads the cartridge into the main body of the printing apparatus. Maintenance is made easier since an image carrier (50), a charger (51), a developing unit (developer roll) (52), a cleaning unit (53), and the like, are formed integrally into the cartridge. Cartridges of this type are disclosed, for example, in U.S. Pat. Nos. 3,985,436; 4,500,195; 4,540,268; 4,627,701; 5,995,774; and 6,009,285; all of which are incorporated herein by reference.

In such a process cartridge, the developing unit is provided with a sealing member (55) so that the toner will not leak out from a gap formed between the developer roll (52) and a development frame member (54). The cleaning unit (53) has a sealing member (56) provided in the end portion of the image carrier (50) so that waste toner will not leak out from the gap formed between the end portion of the image carrier (50) and the waste toner well (53a).

Sealing between the developer roll (52), the doctor blade (57), and the developer housing (frame) (54) is difficult because the developer roll is a rotating cylinder immersed in toner for a portion of its revolution and exposed external to the developer unit for the other portion of the cycle. The doctor blade moves in a direction perpendicular to the tangential surface velocity of the developer roller making sealing difficult. A seal must also be made between the doctor blade seal and the lower developer roll seal that extends the length of the developer housing to the other end seal.

One type of the above-mentioned sealing member is formed from foam rubber, felt or the like so that it can be applied onto a container. Another type is formed from a material such as plastic, as a lip portion which slideably contacts process means such as the developer sleeve (52), the frame member (54) or the like so that the seal can be installed into the frame member. With the former sealing member, it is time-consuming to apply the sealing member and automation of attachment is difficult. The latter sealing member has the advantage that attachment is easy. However, the dimensions of the portion where the sealing member

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comes into close contact with the frame member varies, causing the problem, for example, of the toner leaking from the gap.

A commonly used seal on laser printer toner cartridges incorporates a dynamic seal design consisting of two lip seals in contact with the developer roll and doctor blade that are angled relative to the developer roll surface velocity direction in order to actively push (snowplow) toner back into the developer sump. This seal design requires an internal pocket in the developer housing for retention and support. This pocket can be created in cartridges by attachment of external pieces, such as end caps. These external pieces add additional costs to the toner cartridge and add additional part interfaces that can allow toner leakage if not sealed by an additional means. The additional means of sealing these end cap interfaces is frequently accomplished by the use of a putty substance and/or a wax substance. Application of these substances onto the cartridge is difficult, costly, and they are prone to contaminate other critical areas of the cartridge when mis-installed. This type of seal is described in IBM Technical Disclosure Bulletin, Vol. 33, No. 38, pg. 29 (1990).

U.S. Pat. No. 5,697,021, Watanabe, et al., issued Dec. 9, 1997, describes a sealing means for a toner cartridge formed from a soft plastic material. The U-shaped seal mounts on the end of the cartridge (see FIG. 11 of the Watanabe, et al. patent) and may include an extended lip which scrapes toner off the doctor blade and back into the toner sump (see FIG. 6 of the Watanabe, et al. patent). These structures do not utilize ridges on the inside face of the seal to guide toner back into the cartridge. See also, U.S. Pat. No. 5,475,467, Watanabe, et al., issued Dec. 12, 1995.

U.S. Pat. No. 5,550,617, Odagawa, et al., issued Aug. 27, 1996, describes a process cartridge for an electrophotographic printer, the elements of which are made from a synthetic resin, making recycling of the cartridge components easy and effective. End-seals made from the synthetic resin are disclosed; they may be integral with the blade members or the blade supports. Again, there is no discussion of placing ridges on the inside face of the seal to guide toner back into the cartridge (see FIGS. 8-11 of the Odagawa, et al. patent).

U.S. Pat. No. 5,502,547, Shirai, issued Mar. 26, 1996, describes sealing members for use in a toner cartridge which comprise a resin face plate having a tongue and groove means on one face for attaching to the printer, and a foam portion on the other face to form the seal (see FIG. 8 of the Shirai patent). The key to this patent is that the seals can be recycled. Again, there is no discussion of using ridges on the interior face of the seal.

### SUMMARY OF THE INVENTION

The present invention relates to a sealing member for an image-forming apparatus including a frame member, a rotary member and a blade member, said sealing member comprising:

- a rotary seal portion for sealing a space formed between the frame member and the rotary member, said rotary seal portion incorporating ridges set at an angle across its face adjacent to the surface of said rotary member;
  - a blade seal portion for sealing a space formed between the frame member and the blade member; and
  - a means for biasing said sealing member toward the surface of said rotary member and the blade member.
- The seal member is typically made from a flexible, low modulus material, such as urethane or artificial rubber. It is

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generally used to prevent the leakage of toner from an electrophotographic process cartridge; in that instance, the rotary member is generally a developer roll and the blade member is a doctor blade. The means for biasing the seal can be, for example, a cantilever beam, cantilever springs or a foam strip.

The present invention also encompasses a process cartridge detachably mountable to an image-forming apparatus, said process cartridge comprising:

- a frame member;
- a rotary member mounted on said frame member, said rotary member constituting process means;
- a blade member elastically contacting said rotary member; and
- a sealing member comprising
  - a rotary seal portion for sealing a space formed between the frame member and the rotary member, said rotary seal portion incorporating ridges set at an angle across its face adjacent to the surface of said rotary member;
  - a blade seal portion for sealing a space formed between the frame member and the blade member; and
  - a means for biasing said sealing member toward the surface of rotary member and the blade member.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of a prior art toner cartridge.

FIG. 2 is a sectional view of an image-forming apparatus which incorporates the present invention.

FIG. 3 is a sectional view of the process (toner) cartridge which may be loaded into the image-forming apparatus.

FIG. 4a includes front and back isometric views of a seal of the present invention. FIG. 4b is a cross-sectional view of that seal taken at line 4—4.

FIG. 5a includes front and back isometric views of a second embodiment of the seal of the present invention. FIG. 5b is a cross-sectional view of that seal taken at line 5—5.

FIG. 6 is a schematic view showing the placement of the seal of the present invention in relation to the developer roll and doctor blade in a process (toner) cartridge.

FIG. 7 is a cut-away schematic view showing the placement of the seal of the present invention in the process (toner) cartridge of an electrophotographic process.

#### DETAILED DESCRIPTION OF THE INVENTION

A schematic construction of an image-forming electrophotographic apparatus having a process cartridge installed therein and which utilizes the seal of the present invention is described herein. FIG. 2 is a sectional view of an embodiment of an image-forming apparatus of the present invention, such as a laser printer. FIG. 3 is a sectional view of a process cartridge utilized in the apparatus of FIG. 2.

As shown in FIG. 2, the image-forming apparatus (A) projects a light image based on image information from an optical means (1) so that a developing agent (referred to as "toner") image is formed on a photosensitive drum (7) which is an image carrier. Then, a recording medium (2) is fed by feeding means (3) in synchronization with the formation of a toner image, and the toner image formed on the photosensitive drum (7) in the image-forming section, which is integrally included within a process cartridge (B), is transferred to the recording medium (2) by transfer means

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(4). The recording medium (2) then is transferred to fixing means (5) where the transferred toner image is fixed onto the recording medium (2), which is then ejected onto an ejection tray (6).

As shown in FIG. 3, the process cartridge (B), which constitutes the image-forming section, makes a photosensitive drum (7) rotate to uniformly charge the surface thereof by charging means (8) and exposes a light image from the optical means onto the photosensitive drum (7) via an exposure section (9) to form a latent image on the photosensitive drum (7). A toner image corresponding to the latent image is formed by developing means (10), thus making the image visible. After the toner image is transferred to the recording medium (2) by the transfer means (4), toner remaining on the photosensitive drum (7) is removed by cleaning means (11). These elements, including the photosensitive drum (7), are housed inside a toner development frame member (12) and a cleaning frame member (13), which together constitute a housing, so that they are formed into a cartridge. Each part of the process cartridge (B) is provided with a sealing member for preventing the toner from leaking.

The construction of each part of the image-forming electrophotographic apparatus (A) will be explained in the following order: optical means, feeding means, transfer means, fixing means, and cartridge mounting means.

The optical means (1) projects a light image onto the photosensitive drum (7) by projecting light on the basis of image information read from an external apparatus or the like. As shown in FIG. 2, a laser diode (1b), a polygon mirror (1c), a scanner motor (1d), and an image-forming lens (1e) are housed inside an optical unit (1a) of the main body (14) of the apparatus. When, for example, an image signal is supplied from an external apparatus such as a computer or word processor, the laser diode (1b) emits light in response to the image signal, and projects the light onto the polygon mirror (1c) as image light. Polygon mirror (1c) is rotated at high speed by the scanner motor (1d). The image light reflected by the polygon mirror (1c) is projected onto the photosensitive drum (7) via the image-forming lens (1e) and reflecting mirror (1f). The surface of the photosensitive drum (7) is thus selectively exposed to form a latent image corresponding to the image information.

The feeding means (3) for feeding the recording medium (2) (e.g., recording paper, OHP sheet, cloth, or thin plate) comprises the following components. A loading portion of a cassette (3a) is provided in the inner bottom portion of the main body (14) of the apparatus. When an image formation start signal is input, the recording media (2) within the cassette (3a) are fed one-by-one from the top of the stack by a pickup roller (3b), feeding rollers (3c) and follower rollers (3d) pressed against the feeding roller (3c).

The sheet of recording medium (2) is fed to the nip portion between the photosensitive drum (7) and the transfer means (4) in synchronization with the performing of the image-formation operation described above; the image is transferred to the recording medium. The recording medium (2) onto which a developed image has been transferred is fed to the fixing means (5) and then ejected onto the ejection tray (6) by a pair of intermediate ejection rollers (3e) and a pair of ejection rollers (3f). A pair of guide members (3g) for guiding the feeding of the recording medium (2) is provided between each of the above-mentioned pairs of rollers.

The transfer means (4) transfers the developed latent image or toner image formed on the photosensitive drum (7) in the image-forming section onto the recording medium (2).

The transfer means (4) in this embodiment consists of the transfer roller (4) as shown in FIG. 2. That is, the recording medium (2) is pressed by the transfer roller (4) against the photosensitive drum (7) of the loaded process cartridge (B). A voltage having a polarity opposite that of the latent image formed on the photosensitive drum (7) is applied to the transfer roller (4) so that the toner on the photosensitive drum (7) is transferred to the recording medium (2).

The fixing means (5) fixes the toner image transferred to the recording medium (2) by applying heat and pressure to the recording medium (2) carrying the toner image. As shown in FIG. 2, the fixing means (5) comprises a driving rotating roller (5a) having a heater (5b) therein, and a fixing (pressure) roller (5c), rotating in a driven manner in pressed contact with the drive roller (5a). More specifically, when the recording medium (2) to which the toner image has been transferred moves between drive roller (5a) and fixing roller (5c), heat is applied by the heater located in the driving rotating roller (5a) and pressure is applied to the recording medium by the fixing roller (5c), thereby causing the toner (which comprises a colorant and a thermoplastic component) on the recording medium (2) to melt and become fixed to the recording medium (2).

A process cartridge loading means by which the process cartridge (B) is loaded into the image forming apparatus is disposed within that apparatus (A). Loading and unloading of the process cartridge (B) to and from the main body (14) of the apparatus is performed by opening an open/close cover (15). Open/Close cover (15) may be provided with a conventional hinge (not shown) so that it can be opened or closed, and is mounted in the upper portion of the main body (14) of the apparatus. Opening the open/close cover (15) reveals a cartridge loading space provided inside the main body (14) of the apparatus, including conventional left and right guide members (not shown) mounted on the left and right inner-wall surfaces of the main body (14). Each of these guide members is provided with a guide for inserting the process cartridge (B). The process cartridge (B) is inserted into and along the guides, and by closing the open/close cover (15), the process cartridge (B) is loaded into the image-forming apparatus (A).

The components of the process cartridge (B) will now be described.

The process cartridge (B) comprises an image carrier and at least one process means. The process means includes charging means for charging the surface of the image carrier, developing means for forming a toner image on the image carrier, cleaning means for cleaning the toner remaining on the surface of the image carrier, and the like. In the process cartridge (B) of the present invention, as shown in FIG. 3, the charging means (8), the exposure section (9), the developing means (10), and the cleaning means (11) are arranged around a photosensitive drum (7), which is an image carrier. These elements are covered with a frame member formed of the toner development frame member (12) and the cleaning frame member (13) so that they are formed into one unit, thus making it possible to load and unload the unit into and out of the main body (14) of the apparatus. The process cartridge (B) comprises the following elements: the photosensitive drum (7), the charging means (8), the exposure section (9), the developing means (10) and the cleaning means (11).

The photosensitive drum (7) generally has an organic photosensitive layer coated onto the outer peripheral surface of a cylindrical drum base formed from aluminum. The photosensitive drum (7) is rotatably mounted on a frame

member of the cartridge and the driving force of a drive motor disposed in the main body (14) of the apparatus is transmitted to a drum cap (not shown). As a result, the photosensitive drum (7) is caused to rotate in the direction of the arrow in FIG. 2 in accordance with the performance of an image-forming operation.

The charging means (8) is used to uniformly charge the surface of the photosensitive drum (7). In the embodiment shown, a so-called contact charging method in which the charging means (8) is mounted on frame member (14) is used.

The charging means (8) is brought into contact with the photosensitive drum (7) so that the charging means (8) contacts the photosensitive drum (7) during the image formation. A DC voltage is applied to the charging means (8), and the surface of the photosensitive drum (7) is uniformly charged.

An exposure section (9) exposes a light image projected from the optical means onto the surface of the photosensitive drum (7) uniformly charged by the charging roller (8) so that a latent image is formed on the surface of the photosensitive drum (7). An opening (9) for guiding the light image onto the top surface of the photosensitive drum (7) is provided to form the exposure section.

As shown in FIG. 3, the developing means includes a toner well (10a) or housing toner, and a rotary paddle toner feeding member (10b). The toner feeding member (10b) is provided within toner well (10a) and rotates as shown in FIG. 3, to circulate toner within the toner well (10a). A developer roll (10d) forms a thin toner layer on the surface thereof as a result of its rotation and is pressed against the photosensitive drum (7).

A development blade (also called a "doctor blade") (10e) is disposed adjacent the developer roll (10d) to regulate the thickness of the toner layer formed therebetween. The electric charge is imparted to the toner by a biasing voltage on the doctor blade.

As shown in FIG. 3, the cleaning means (11) comprises a cleaning blade (11a), positioned in contact with the surface of the photosensitive drum (7) for scraping off the toner remaining on the photosensitive drum (7), a skimming seal (11b), positioned below the cleaning blade (11a) arranged in weak contact with the surface of the photosensitive drum (7), for retaining up the toner which has been scraped off, and a waste toner well (11c) for storing the scraped-off waste toner.

The key aspect of the present invention is the unique seal used to seal the end portions of the developing roller (10d), the doctor blade (10e) and the developer housing (12) and to keep toner from leaking out at that junction (K1). The seals (75) of the present invention comprise a molded (for example, injection molded or compression molded) part having a ridged surface located adjacent to the developing roller, wherein the ridges run at an angle to the developer roll process direction in order to actively "snowplow" toner off the developer roll surface.

Examples of seals of the present invention are shown in FIGS. 4 and 5. The seals comprise a rotary seal portion (70) which seals the space formed between the frame member and the rotary member of the image-forming apparatus. The rotary seal portion has two flat faces. The face of the rotary seal portion which is adjacent to the surface of the rotary member is shown on the left side of FIGS. 4 and 5 and contains the ridges. The ridges run at an angle to the process direction of the rotary member, generally the developer roll (about 1° to about 45° (preferably about 10°), arranged to



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move toner from the end of the roll toward the middle). By positioning the ridges in this way, they act to push toner away from the edge of the developer roll. The height of the ridges generally is from about 0.05 to about 0.5 mm, preferably about 0.1 mm. The width of the ridges is generally from about 0.01 to about 0.5 mm, preferably about 0.2 mm. The ridges at their base may form an acute angle at their peak, but preferably form a right angle (to the surface of the developer roll) at their peak. In FIGS. 4 and 5, the ridges are denoted as (71). The seal also includes a means for biasing the rotary seal portion toward the surface of the rotary member. This may be accomplished in any way which holds the seal against the rotary member without impairing the rotation of the rotary member. Examples of such biasing means include the use of a cantilever beam, cantilever springs or a foam strip on the face of the rotary seal portion which is facing away from the surface of the rotary member. In FIGS. 4a and 5a, (72) denotes two different embodiments of the biasing means. The cross-sectional structure of these biasing means (as well as the ridges) is shown in FIGS. 4b and 5b. The preferred biasing means is a cantilever spring structure.

The seal also includes a blade seal portion (73) for sealing the space formed between the frame member and the blade member (generally the doctor blade) in the image forming apparatus. The blade seal portion of the seal is generally formed such that it is held in place between the blade member and the frame member when positioned in use. The biasing means, discussed above, also biases the blade seal portion (73) against the blade member.

The seal can be molded from any flexible, low modulus material known in the art. Examples of such materials include urethane, and artificial rubber having a Shore A hardness of from about 55 to about 74 (such as Santoprene). Preferred seals are made from an artificial rubber material having a Shore A hardness of from about 55 to about 74. A schematic of the end seal of the present invention in use is shown in FIGS. 6 and 7. In this embodiment, the seal acts effectively to prevent leakage of toner from the developer cartridge.

The seal of the present invention provides advantages over the currently-used seals in a number of respects:

- (1) Ease of assembly. The seal of the present invention can be simply placed in the developer housing and will self-locate after installation of the developer roll. Prior art designs require press fitting into a side pocket and the positioning requirements are precise.
- (2) Elimination of unnecessary parts. The features needed for support of and mating with the seal of the present invention can all be molded integrally into the developer housing. This eliminates the need for attachment of end caps on either end of the developer roll. Eliminating the need for these end caps allows all the critical features in the developer to be molded into a single housing piece, thus allowing tighter tolerances and simpler developer housing manufacture.
- (3) Elimination of other sealants, such as wax and putty. Elimination of weld lines and other joints in the front of the developer housing removes the need for using sealants such as wax and putty that are frequently used to seal these joints. The wax and putty are difficult to install, must be installed very precisely to seal properly, and can contaminate other portions of the developer cartridge.

Although the seals of the present invention have been illustrated using the specific embodiments described herein,

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the present invention is intended to encompass the seals as broadly described herein, including all equivalent structures of those specifically described in the present application.

What is claimed is:

1. A sealing member for an image forming apparatus including a frame member, a developer roll and a blade member, structured so as to prevent leakage of toner in the image forming apparatus, said sealing member being made from a flexible, low modulus material and comprising:

a rotary seal portion for sealing a space formed between the frame member and the developer roll, said rotary seal portion incorporating ridges set at an angle across its face adjacent to the surface of said developer rolls, said ridges being from about 0.05 to about 0.5 millimeters in height and running at an angle to the developer roll process direction so as to push toner away from the edge of said developer roll as said developer roll rotates;

a blade seal portion for sealing a space formed between the frame member and the blade member; and

a means for biasing said sealing member toward the surface of said rotary member and said blade member.

2. The sealing member according to claim 1 wherein the means for biasing is selected from cantilever beams, cantilever springs, foam springs, and combinations thereof.

3. The sealing member according to claim 2 wherein the means for biasing are cantilever springs.

4. The sealing member according to claim 1 made from a material having a Shore A hardness of from about 55 to about 74 selected from the group consisting of urethane, artificial rubber, and combinations thereof.

5. The sealing member according to claim 4 made from artificial rubber.

6. The sealing member according to claim 1 wherein a width of the ridges at their base is from about 0.01 to about 0.5 millimeters.

7. The sealing member according to claim 6 wherein the ridges form an approximate right angle to the rotating surface at their peak.

8. The sealing member according to claim 7 wherein the height of the ridges is about 0.1 millimeter, the width of the ridges at their base is about 0.2 millimeters, the means for biasing are cantilever springs, and the seal is made from an artificial rubber having a Shore A hardness of from about 55 to about 74.

9. The sealing member according to claim 1 wherein the blade end portion is structured so as to be held in place between the blade member and frame member in use.

10. A process cartridge detachably mountable to an image forming apparatus, said process cartridge comprising:

a frame member;

a developer roll mounted on said frame member; said developer roll constituting process means;

a blade member elastically contracting said rotary member; and

a sealing member to prevent leakage of toner from the cartridge, said sealing member being made from a flexible, low modulus material, said sealing member comprising:

a rotary seal portion for sealing a space formed between the frame member and the developer roll, said rotary seal portion incorporating ridges set at an angle across its face adjacent to the surface of said developer roll, said ridges being from about 0.05 to about 0.5 millimeters in height and running at an angle to the developer roll process direction so as to push toner away from the edge of said developer roll in use;

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- a blade seal portion for sealing a space formed between the frame member and the blade member, and
- a means for biasing said sealing member toward the surface of said rotary member and said blade member.

11. The process cartridge according to claim 10 wherein the biasing means on the seal is selected from cantilever beams, cantilever springs, foam strips, and combinations thereof.

12. The process cartridge according to claim 11 wherein the seal member is made from a material having a Shore A hardness of from about 55 to about 74 selected from urethane, artificial rubber, and combinations thereof.

13. The process cartridge according to claim 12 wherein the seal member is made from an artificial rubber.

14. The process cartridge according to claim 12 wherein the means for biasing on the seal member are cantilever springs.

15. The process cartridge according to claim 10 wherein a width of the ridges at their base on the sealing member is from about 0.01 to about 0.5 millimeters.

16. The process cartridge according to claim 15 wherein the ridges on the sealing member form an approximate right angle at their peak.

17. The process cartridge according to claim 16 wherein, in the sealing member, the height of the ridges is about 0.1 millimeter, the width of the ridges at their base is about 0.2 millimeters, the means for biasing are cantilever springs, and the sealing member is made from artificial rubber having a Shore A hardness of from about 55 to about 74.

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18. The process cartridge according to claim 10 wherein the blade end portion of the sealing member is structured so as to be held in place between the blade member and the frame member in use.

19. A process cartridge detachably mountable to an image forming apparatus, said process cartridge comprising:

- a frame member;
- a developer roll mounted on said frame member; said developer roll constituting process means;
- a blade member elastically contracting said rotary member; and
- a sealing member to prevent leakage of toner from the cartridge, said sealing member being made from a flexible, low modulus material, said sealing member comprising:
  - a rotary seal portion for sealing a space formed between the frame member and the developer roll, said rotary seal portion incorporating ridges set at an angle across its face adjacent to the surface of said developer roll, said ridges running at an angle of about 10° to the developer roll process direction so as to push toner away from the edge of said developer roll in use;
  - a blade seal portion for sealing a space formed between the frame member and the blade member, and
  - a means for biasing said sealing member toward the surface of said rotary member and said blade member.

\* \* \* \* \*

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January 04, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
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ISSUE DATE: *December 17, 2002*

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
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T. LAWRENCE  
Certifying Officer







US006496662B1

(12) **United States Patent**  
**Buchanan et al.**

(10) **Patent No.:** **US 6,496,662 B1**  
(45) **Date of Patent:** **Dec. 17, 2002**

(54) **OPTICAL TONER LOW SENSOR**

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(73) **Assignee:** **Lexmark International, Inc.**, Lexington, KY (US)

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(52) **U.S. Cl.** ..... **399/27**

(58) **Field of Search** ..... 399/27, 28, 30, 399/49, 61, 64

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*Primary Examiner*—Arthur T. Grimley

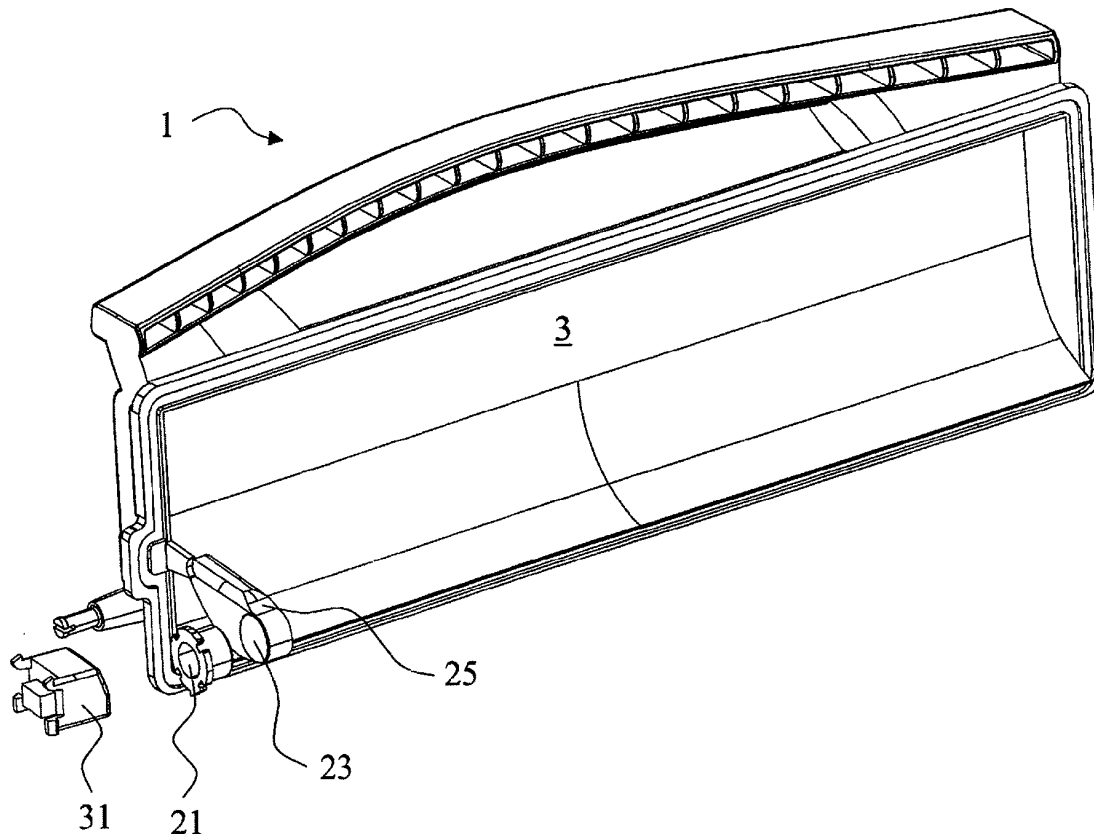
*Assistant Examiner*—Ryan Gleitz

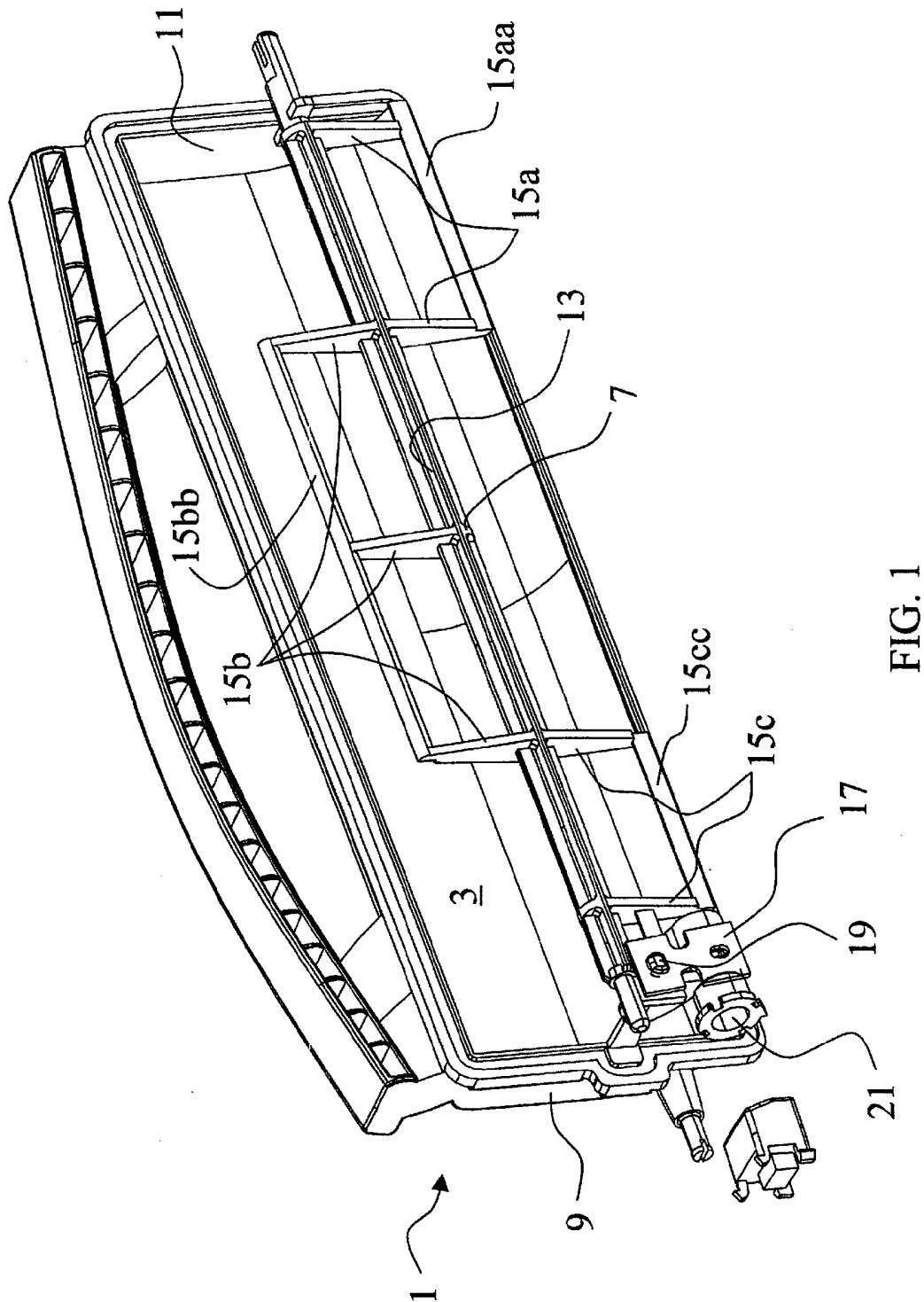
(74) *Attorney, Agent, or Firm*—John A. Brady

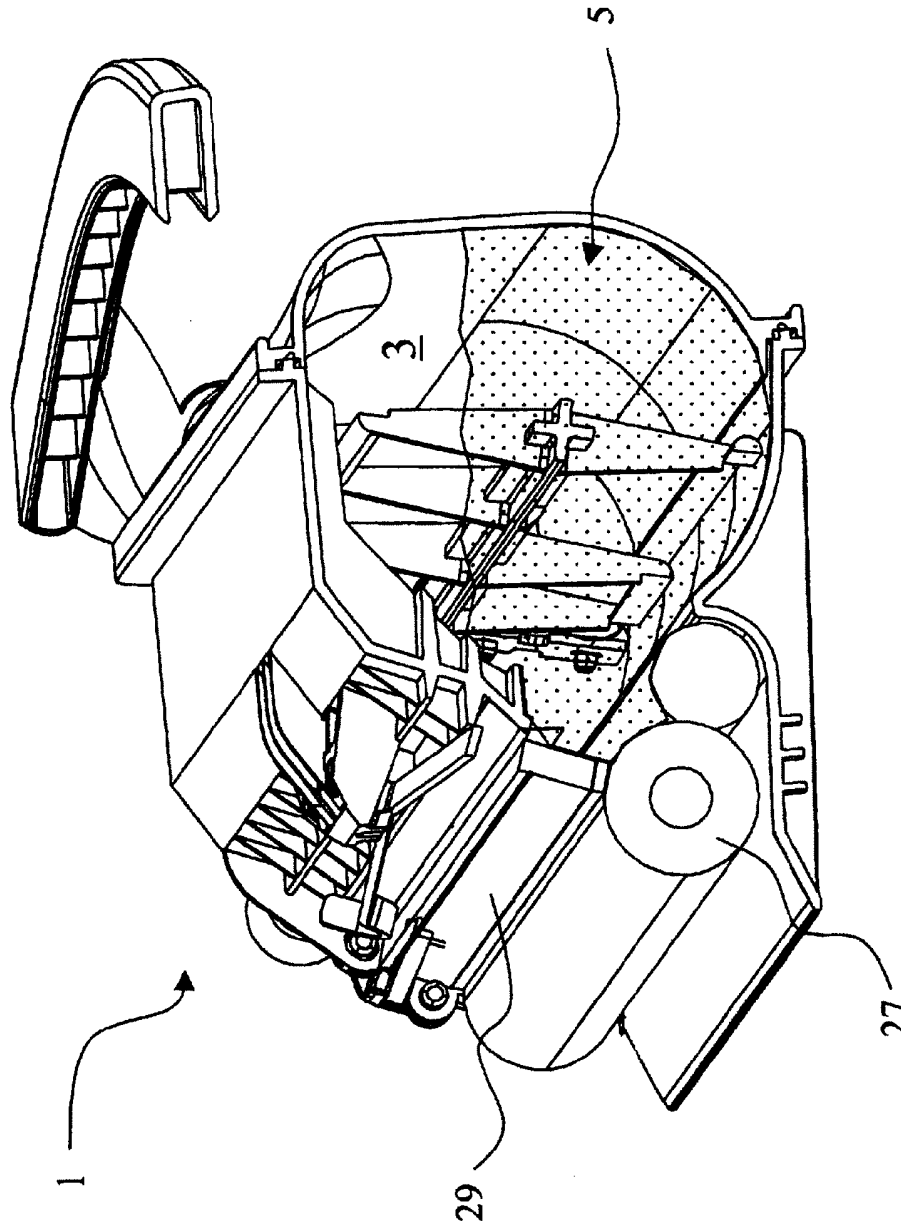
(57) **ABSTRACT**

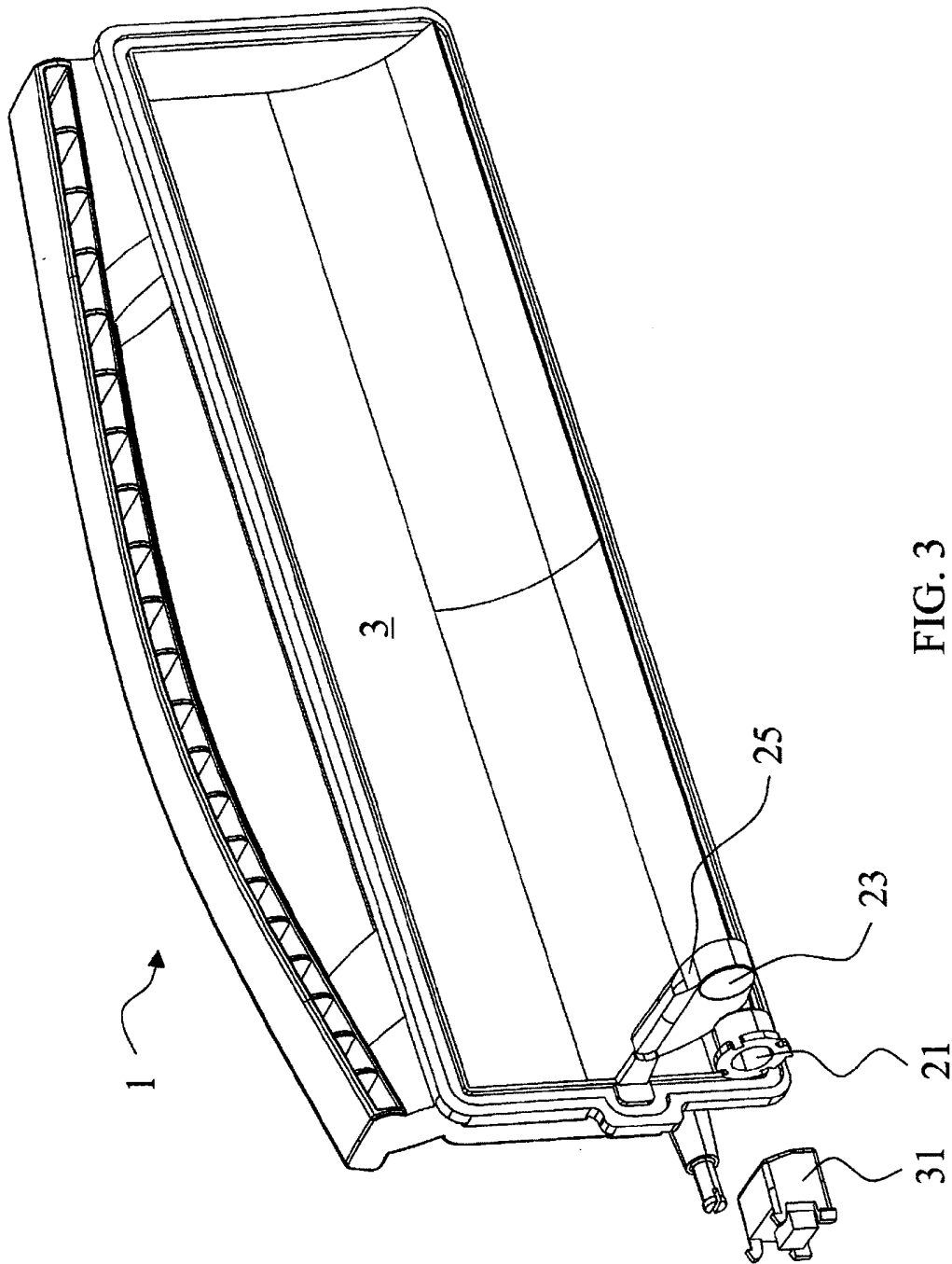
Toner exhaustion is sensed in cartridge (1) having a toner chamber (3), a rotation paddle (7) extending across the long dimension. Chamber (3) has a transparent window (21) at its bottom and a reflective surface (23) in chamber (3), also at the bottom. An optical emitter and receiver (31) periodically senses for returned light, which indicates toner low. Paddle (7) carries a wiper to clean window and reflective surface. This provides improved accuracy by a cost-effective system.

**8 Claims, 4 Drawing Sheets**









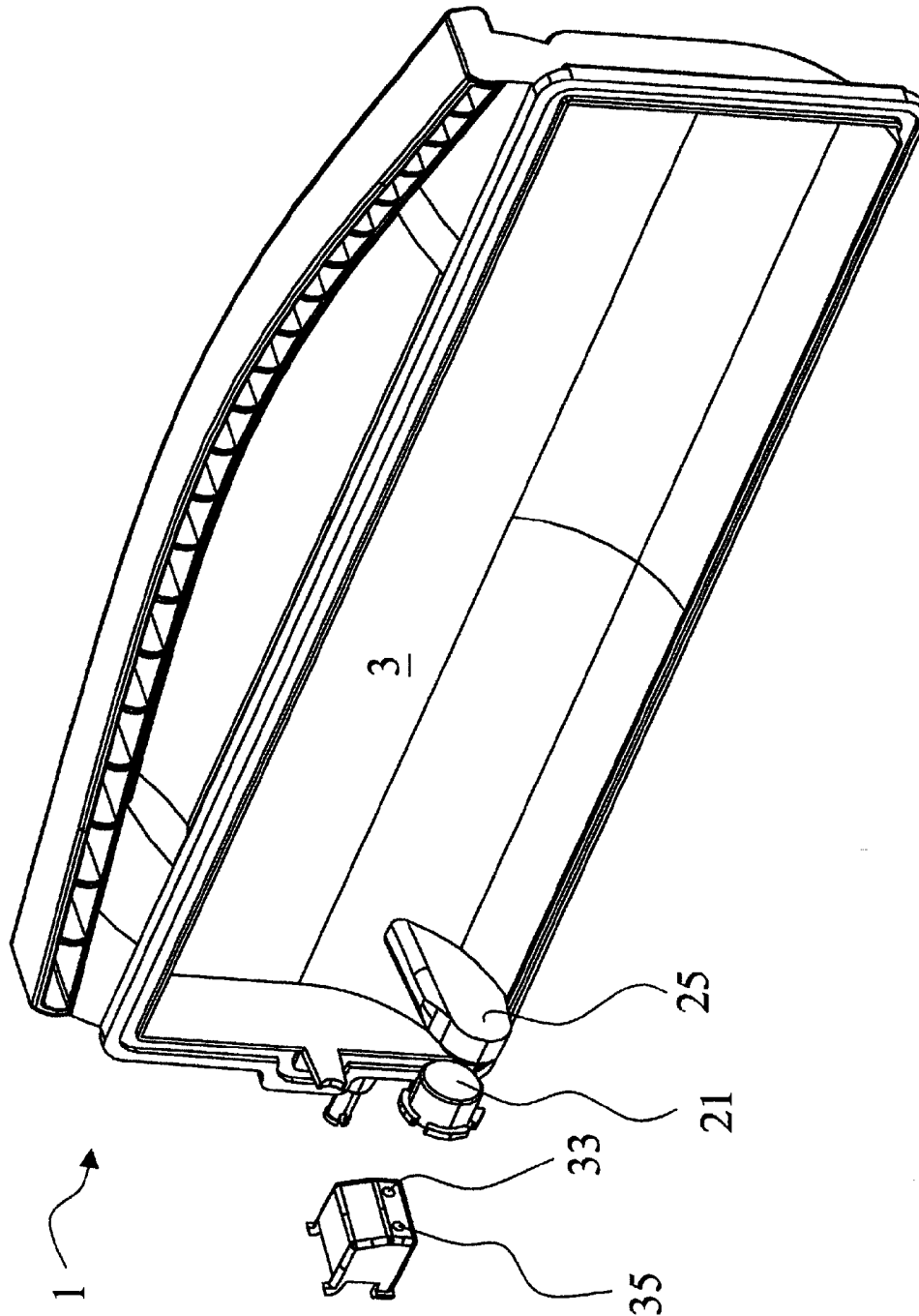


FIG. 4

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## OPTICAL TONER LOW SENSOR

## TECHNICAL FIELD

This invention relates to electrophotographic process cartridges having toner and is directed to sensing the exhaustion of toner so that such information can be signaled to the imaging machine operator or otherwise acted upon.

## BACKGROUND OF THE INVENTION

A number of alternatives are known for sensing the amount of toner in an imaging process cartridge. In cartridges in which a toner paddle stirs the toner during operation, the paddle has been driven through a torque sensitive drive train and the torque sensed has been used to determine the amount of toner remaining. The toner-low sensing of this invention is believed to be more accurate and more cost-effective than such systems in practices.

Similarly, the amount of toner has been determined by weighing the cartridge, with the reduction in weight defining the use of toner. This requires accurate knowledge of the empty weight of the cartridge and accurate weighting mechanism in the printer in varying environment and over the life of the printer. The toner low sensing of this invention also is believed to be more accurate and more cost-effective than such systems.

A number of optical systems are known, using transparent windows in the toner cartridge and optical paths through the toner. In some of these systems a relative small well is formed in the cartridge for toner to occupy, and an optical source is positioned on one side of the well and an optical receiver is positioned to receive light which passes through the well. If no or very low level of light reaches the sensor, this is interpreted as toner still being in the cartridge at the level of the well. It is known to have the well at or near the bottom of the cartridge so as to sense toner exhaustion or near exhaustion. Some of such optical paths might be somewhat complex or lengthy. The toner low sensing of this invention employs optical sensing, but in a short path and without a well.

## DISCLOSURE OF THE INVENTION

In accordance with this invention, the cartridge may have a single window wide enough to permit light to enter the cartridge from a source in the imaging device, be reflected, and then return through the window to a sensor in the imaging device. The window is positioned near the bottom of the toner chamber. The cartridge has a long dimension and has an internal stirring paddle mounted along the long dimension. The cartridge has at least on side generally perpendicular to the long dimension of the cartridge in which the window (or windows) is located. A reflector is mounted in the toner chamber, also near the bottom of the toner chamber, parallel to the window, and not more than 40 millimeters from the window. The paddle carries a compliant blade across the window and the reflector to clean them for sensing.

A high level of light from the source reaching the sensor senses toner low. Because of the positioning near the bottom of the toner container, the most critical information indicative of toner exhaustion is obtained in an accurate and cost-effective system.

## BRIEF DESCRIPTION OF THE DRAWINGS

The details of this invention will be described in connection with the accompanying drawings, in which

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FIG. 1 shows a sectioned perspective view of a toner cartridge having a chamber for toner;

FIG. 2 is sectioned, perspective view from a side showing the rollers and doctor blade making up one side of the toner chamber;

FIG. 3 illustrates the optical system of this invention viewed from the outside of the cartridge; and

FIG. 4 illustrates the optical system of this invention viewed from the inside of the cartridge.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a section view of a toner cartridge 1 having a toner chamber 3. Chamber 3 normally contains toner 5 (see FIG. 2, not shown in the other figures for clarity).

Toner chamber 3 has a long dimension in which a toner paddle 7 is mounted. Paddle 7 extends across the long dimension and generally perpendicular to the left side 9 and right side 11 of cartridge 1, as seen in FIG. 1.

Paddle 7 has a central, driven shaft 13 extending across the long dimension of chamber 3 which is rotated in normal use by a driving member from an imaging device (not shown). Paddle 7 has stirring extensions 15a, 15b, and 15c, which extend to near the outer walls of chamber 3 and which have cross members 15aa, 15bb, and 15cc extending parallel to shaft 13. Extension 15b is on opposite extensions 15a and 15c and cross member 15bb is wider than cross members 15aa or 15cc so as to distribute the stirring action of paddle 7. Paddle 7 with shaft 13 and extensions 15a-15c and cross members 15aa-15cc, rotated by being driven from an imaging device, are essentially well known in the art and therefore will not be described in additional detail.

At the left end of shaft 13, is a single flexible wiper blade 17, made of a solid urethane polymer. Wiper blade 17 is mounted to shaft 13 by studs (top stud numbered) 19 fixed on an extension from shaft 13, and may be fixed to shaft 13 by alternatives such as being wrapped around shaft 13 and held by adhesive or by a rivet, for example.

On the left side and at the bottom of chamber 3 is a transparent plate or window 21. Window 21 may be any material which is transparent to infrared light and is sturdy enough to hold toner 5 inside of the cartridge. Specifically, window 21 is made of polycarbonate.

As best seen in FIG. 3, opposite window 21 and also at the bottom of chamber 3 is a reflective surface 23. Reflective surface 23 is spaced about 9 millimeters away from window 21, and should not be farther than 40 millimeters for suitable operation at low cost. With reference again to FIG. 1, it will be apparent that opposite sides of wiper blade 17 extend outward so as to brush against window 21 and reflective surface 23 during each revolution of paddle 7, thereby cleaning the two surfaces to allow light to pass window 21 and be reflected by surface 23 back through window 21.

Reflective surface 23 is an aluminized plastic sheet which is physically supported in chamber 3 by an extension 25 from the back of chamber, although other supports, such as the bottom of chamber 3, are certainly alternatives. As paddle 7 rotates during use, it distributes toner 5 so that toner remaining after use tends to settle evenly across the bottom of chamber 3, including the area of the bottom of chamber 3 between window 21 and reflective surface 23.

As shown in cross section in FIG. 2, toner 5 is contained in chamber 3 on one side by a developer roller 27 with a doctor blade 29 pressing against the top of developer roller 27. Toner 5 leaves chamber one in small amounts carried



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between roller 27 and blade 29. Paddle 7 distributes the remaining toner 5 so that it is available to the developer roller 27. Such a configuration and operation are entirely conventional.

Developer roller 27 must be at least the width of the paper or other media being imaged. Normally this is somewhat more than the 8 and ½ inches width of paper widely used in the United States. Accordingly the long dimension of cartridge 1 as discussed in the foregoing is at least more than 8 and ½ inches, while the sides 9 and 11, are smaller as larger sides would make cartridge 1 unduly heavy and bulky.

Spaced outside of cartridge 1 as part of the imaging device (not shown) using cartridge 1 is the optical element 31. Optical element 31 is positioned immediately outside window 21. As best seen in FIG. 4, optical element 31 has an infrared emitter 33 and an infrared receiver 35 mounted together for structural convenience. A separate emitter and separate receiver are clearly alternatives.

In use, at periodic intervals, the electronic controls of imaging device (not shown) having optical element 31, cause infrared to be emitted from emitter 33 and causes any sensing of that infrared on receiver 35 to be observed. The sensing of strong, reflected infrared from emitter 33 by receiver 35 is interpreted as toner low. In response to this the imaging device (not shown) may signal this to an operator, shut down automatically, or otherwise take appropriate action.

Such measurement of toner exhaustion is quite accurate and involves only modest cost.

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What is claimed is:

1. A toner cartridge having a long dimension and two opposite sides forming a chamber for toner comprising
  - a toner paddle mounted across said long dimension for rotation to stir toner, an optically transparent area on one of said two sides located at the bottom of said chamber for toner,
  - a reflective surface located in said chamber at the bottom of said chamber spaced away from said transparent area a distance of not more than 40 millimeters.
2. The toner cartridge of claim 1 in which said reflective surface is spaced away from said transparent area a distance of about 9 millimeters.
3. The toner cartridge of claim 1 in which said paddle carries a wiping element, which wipes said transparent area and said reflective surface as said paddle rotates.
4. The toner cartridge of claim 2 in which said paddle carries a wiping element, which wipes said transparent area and said reflective surface as said paddle rotates.
5. The toner cartridge of claim 1 in which said toner chamber contains toner for imaging.
6. The toner cartridge of claim 2 in which said toner chamber contains toner for imaging.
7. The toner cartridge of claim 3 in which said toner chamber contains toner for imaging.
8. The toner cartridge of claim 4 in which said toner chamber contains toner for imaging.

\* \* \* \* \*

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 04, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
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U.S. PATENT: 6,678,489

ISSUE DATE: *January 13, 2004*

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
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T. LAWRENCE  
Certifying Officer



(12) **United States Patent**  
Carter et al.

(10) **Patent No.:** US 6,678,489 B1  
(45) **Date of Patent:** Jan. 13, 2004

(54) **TWO PART CARTRIDGES WITH FORCE BIASING BY PRINTER**

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(73) Assignee: **Lexmark International, Inc.**, Lexington, KY (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/195,270**

(22) Filed: **Jul. 15, 2002**

(51) Int. Cl.<sup>7</sup> ..... **G03G 21/18**

(52) U.S. Cl. .... **399/113; 399/114**

(58) Field of Search ..... 399/113, 114, 399/116, 117, 26, 155, 111, 112, 107

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*Primary Examiner*—Arthur T. Grimley

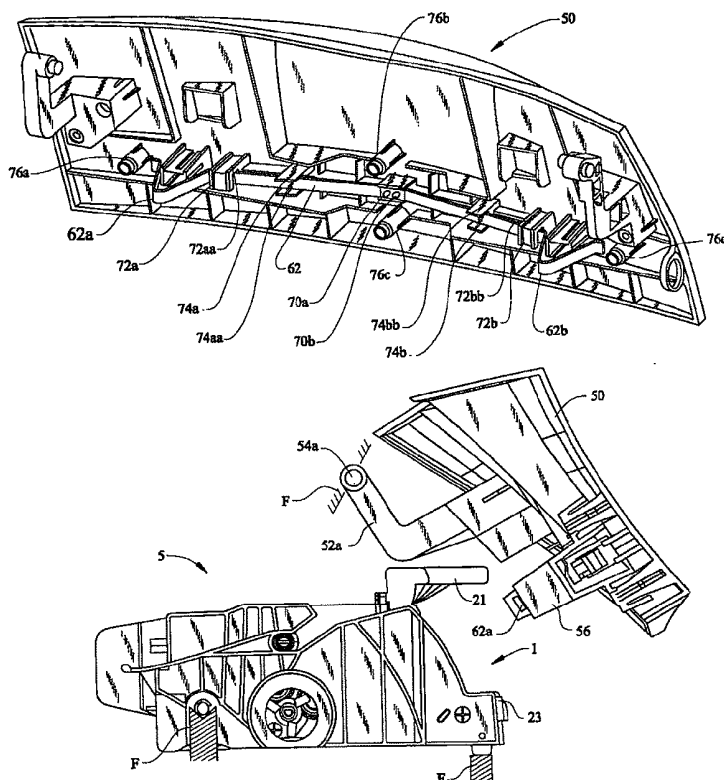
*Assistant Examiner*—Ryan Gleitz

(74) *Attorney, Agent, or Firm*—John A. Brady

(57) **ABSTRACT**

A two part cartridge having a photoconductor part (1) and a toner part (5) having no force biasing element on either part. The two parts fit together so that a developer roller (7) in the toner part contacts a photoconductor drum (3) in the other part. When the two parts are installed in a printer the cover (50), when closed, brings a spring (62) into contact with one side of the toner part while the frame (F) of the printer blocks movement away from the cover. An advantage of the two part cartridge is that the toner part can be replaced without replacing the photoconductor part. Members on the cartridge for force biasing are avoided and the need for training or skill to latch the parts together is avoided.

**6 Claims, 9 Drawing Sheets**



**FIG. 1**

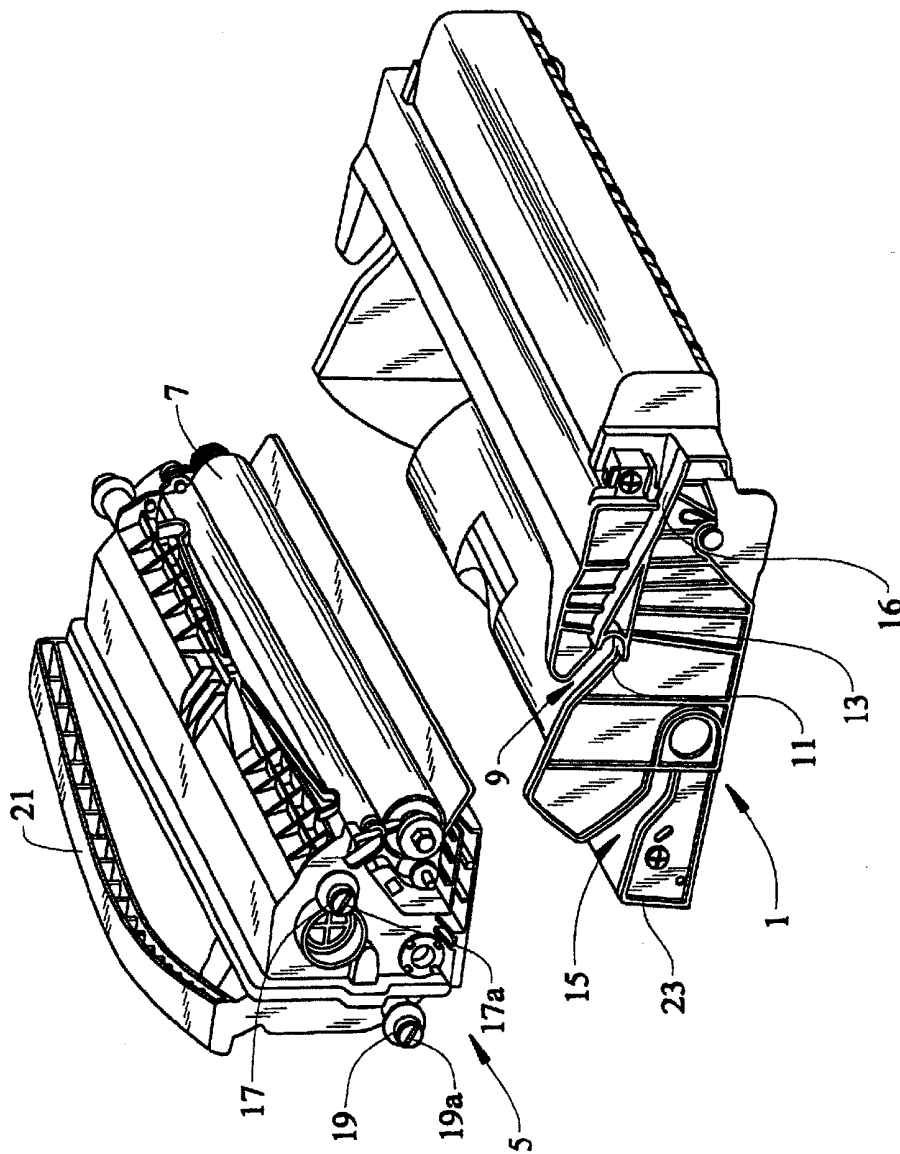


FIG. 2

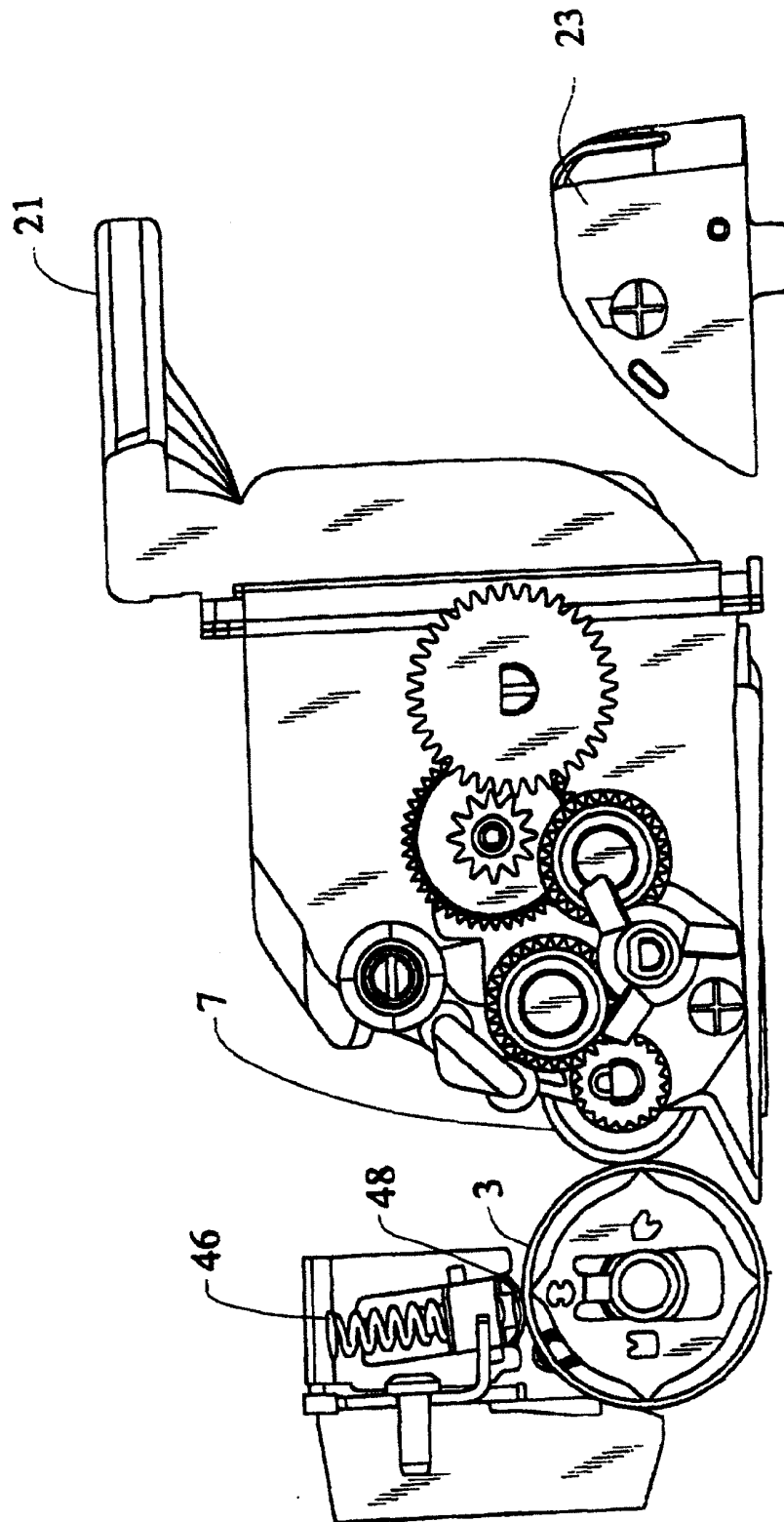
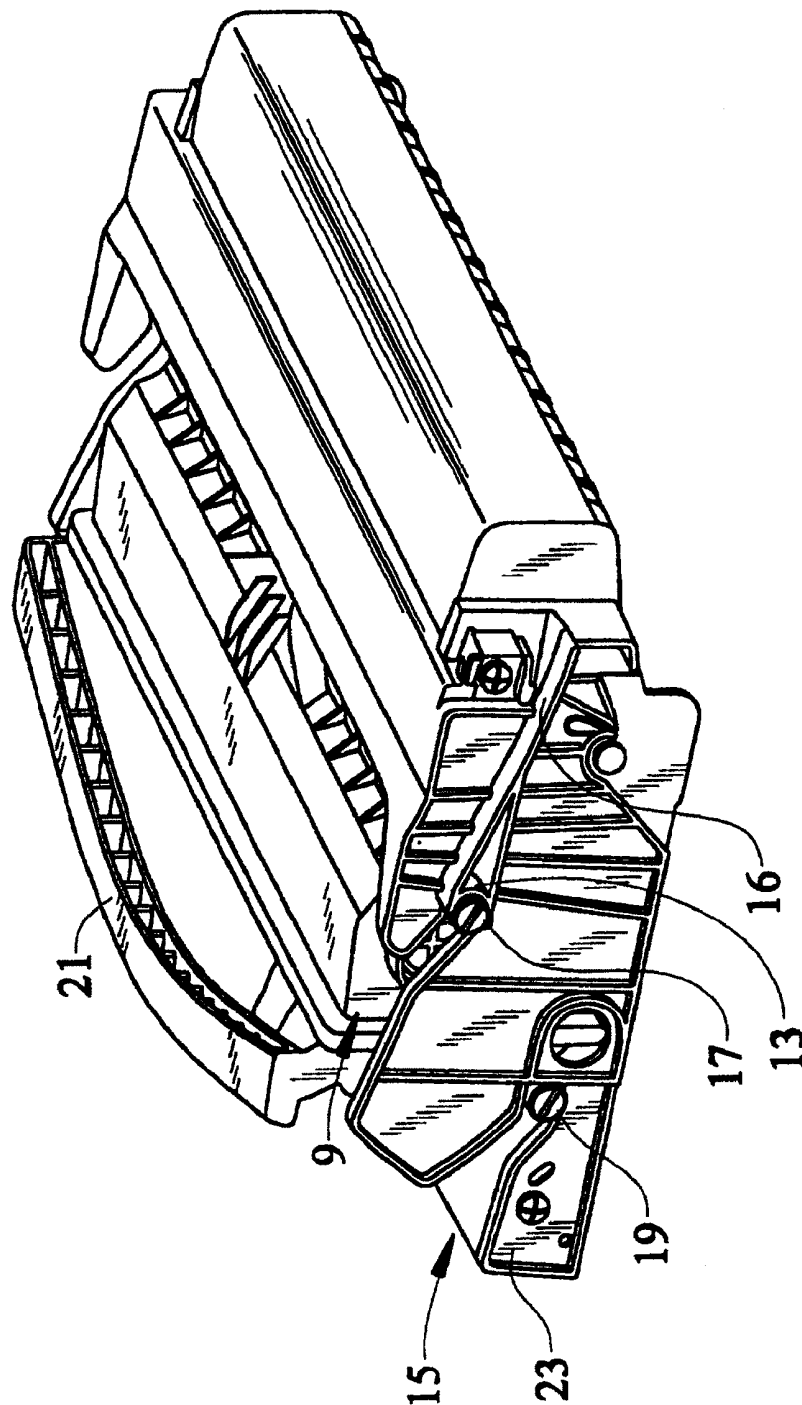


FIG. 3





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FIG. 4

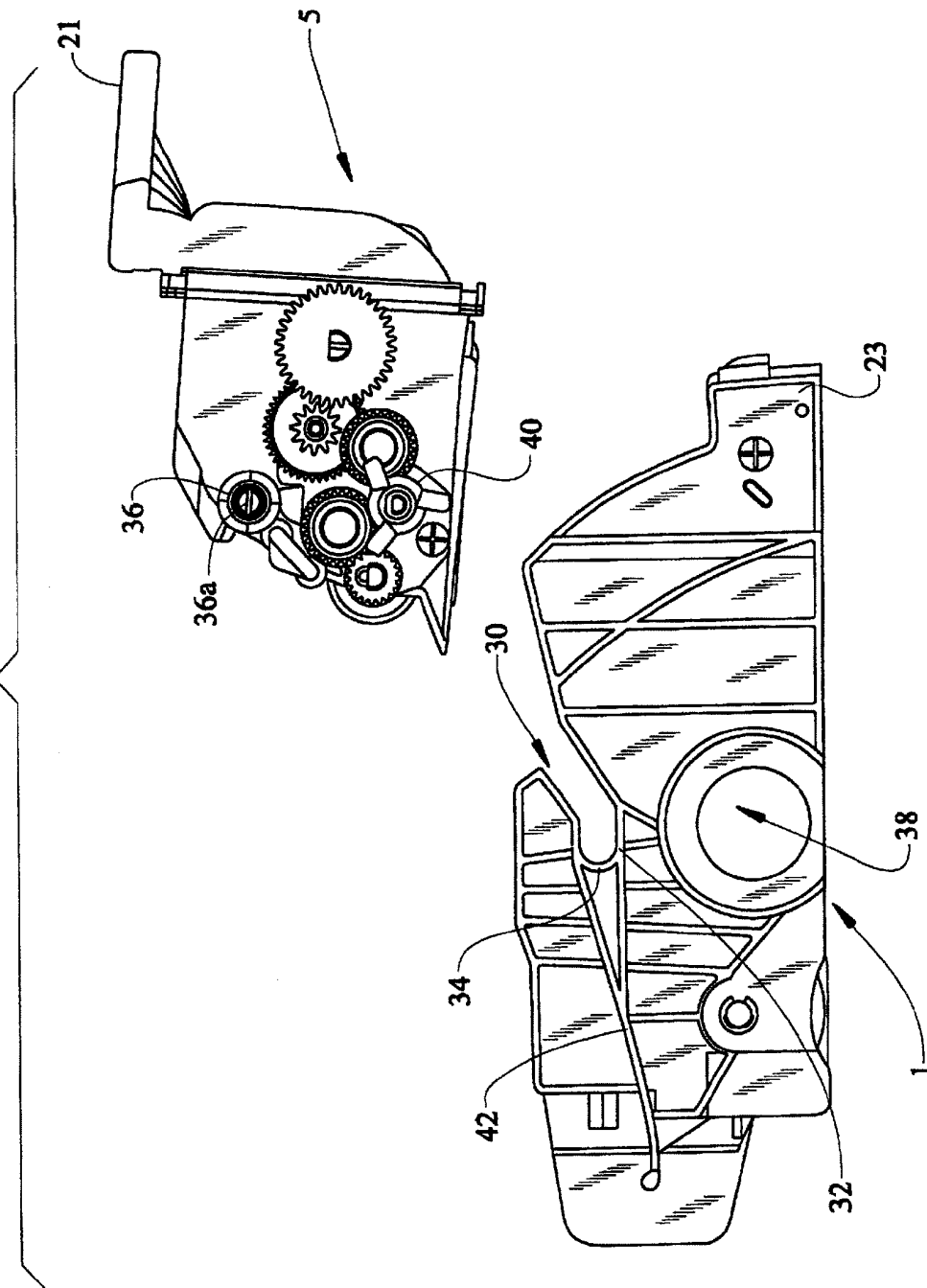
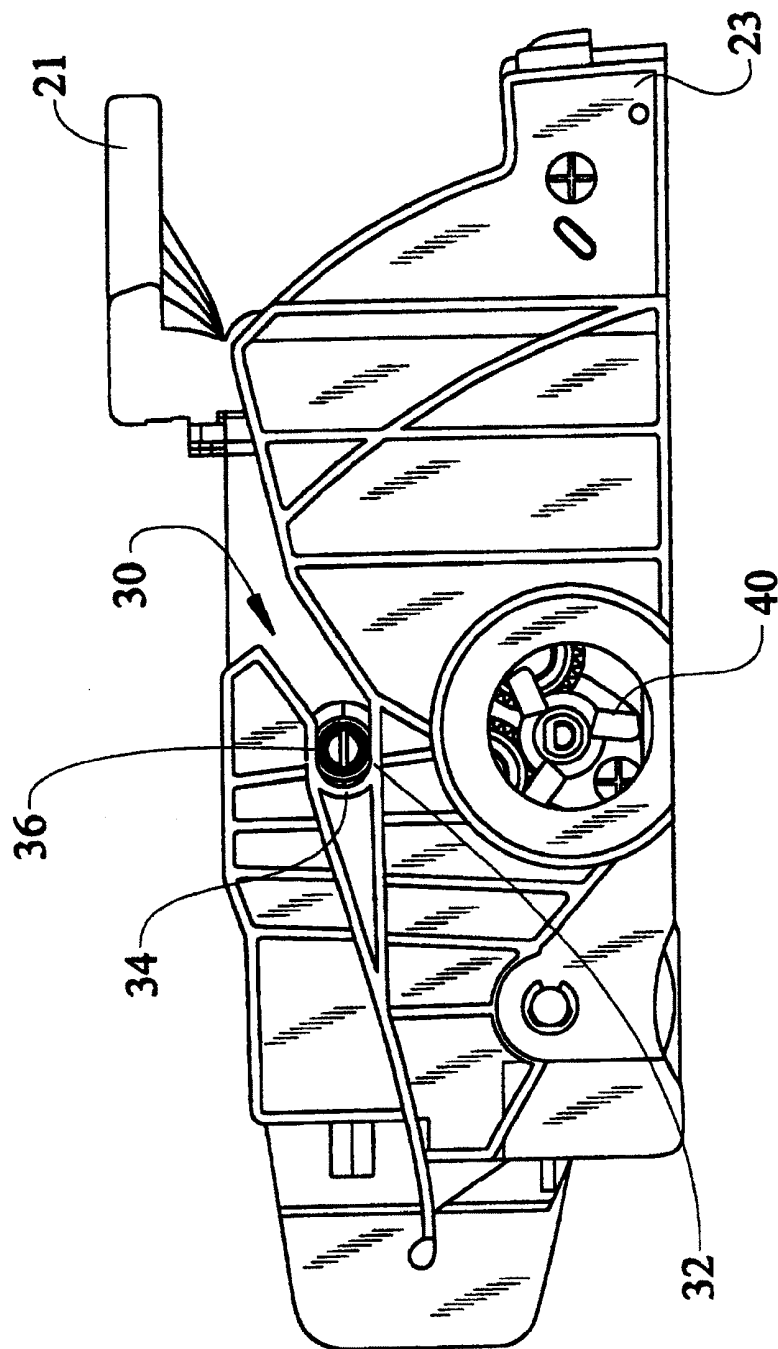


FIG. 5



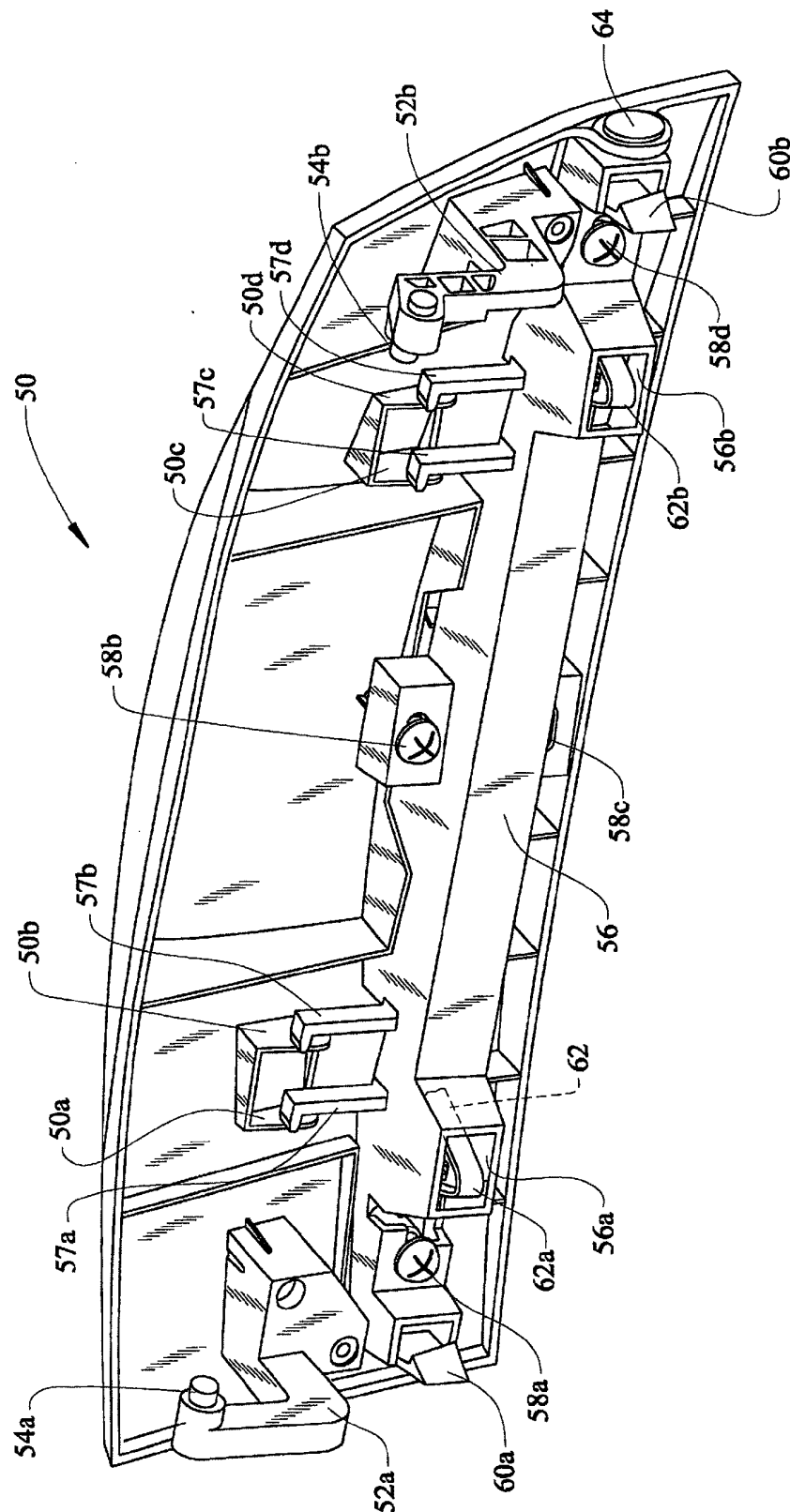
## U.S. Patent

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**FIG. 6**



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FIG. 7

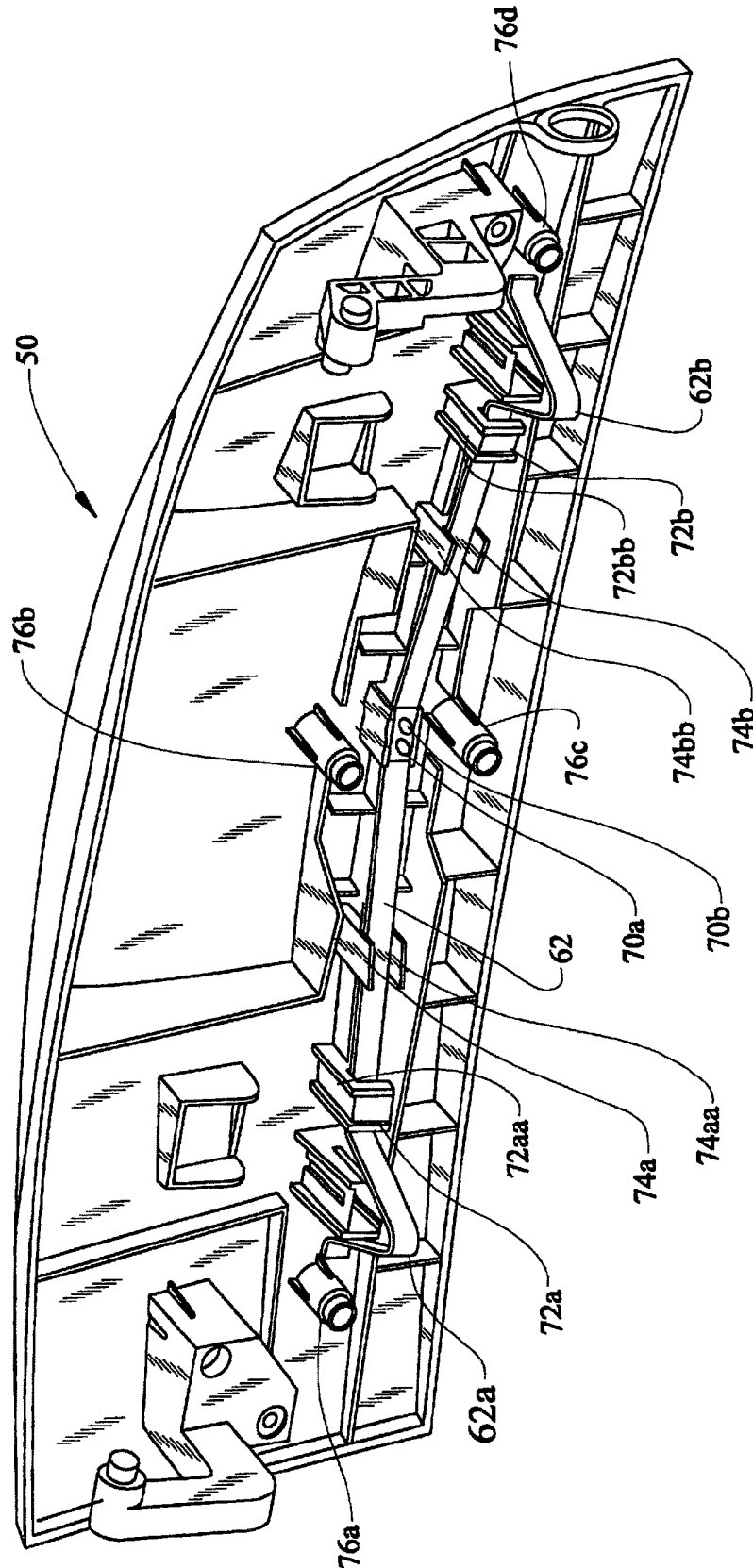


FIG. 8

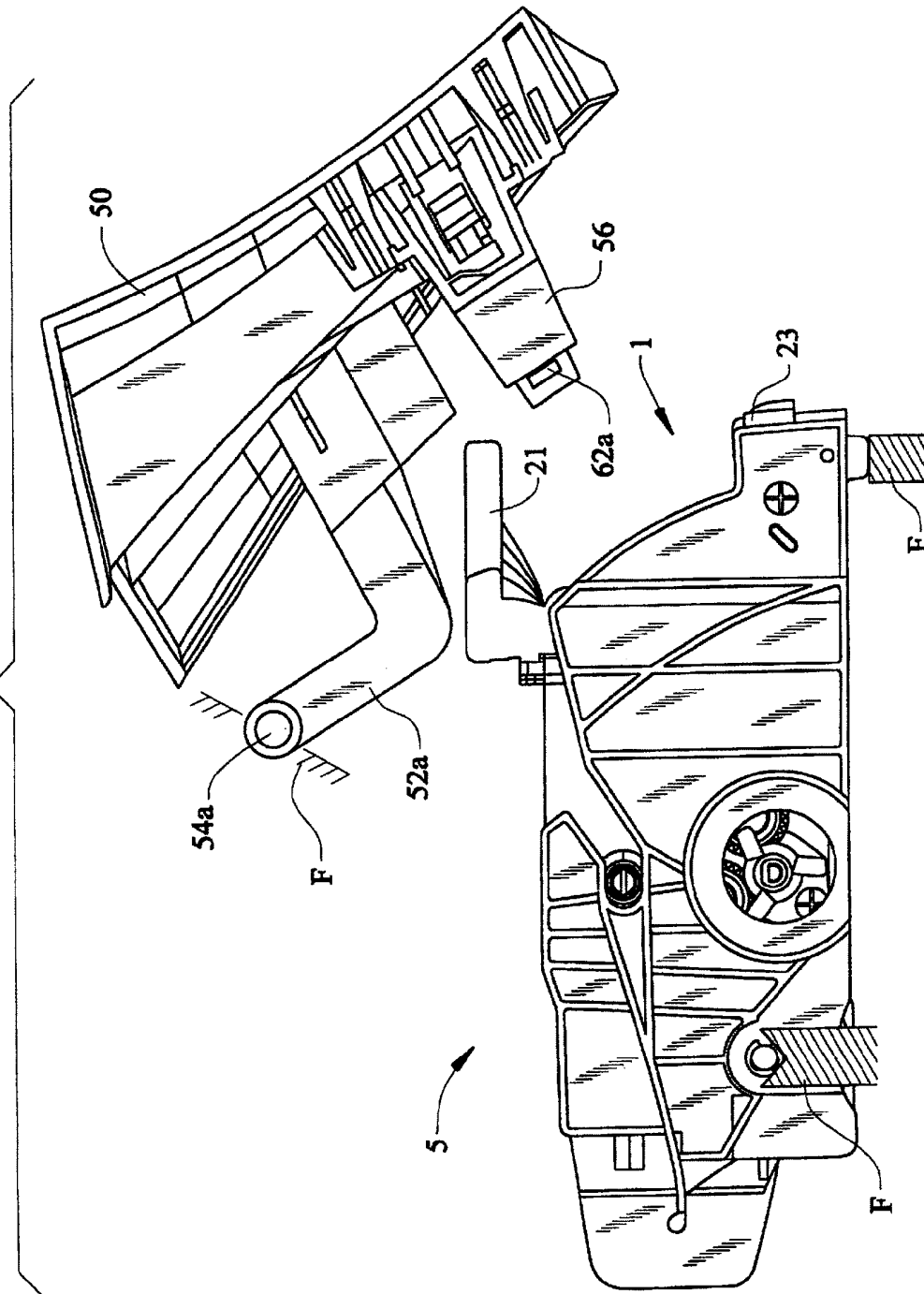
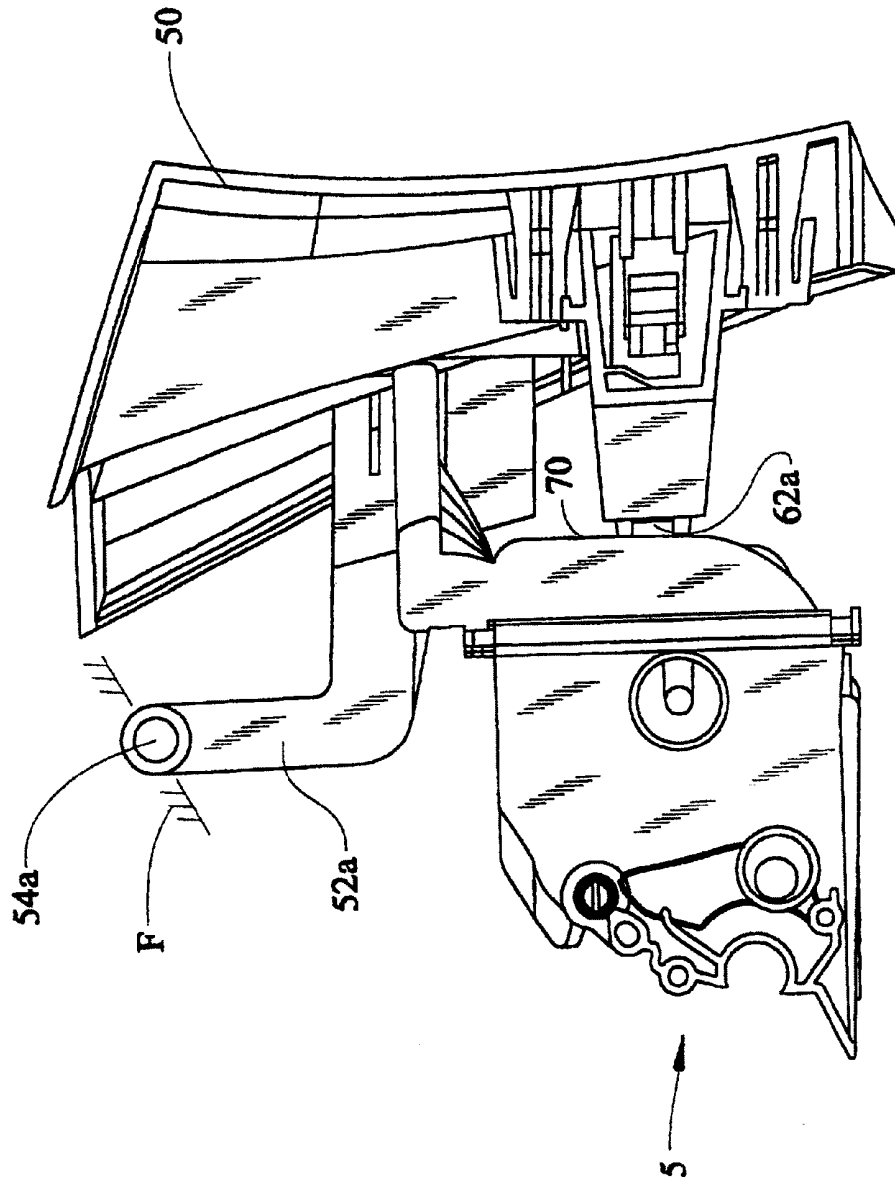


FIG. 9





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## TWO PART CARTRIDGES WITH FORCE BIASING BY PRINTER

### TECHNICAL FIELD

This invention relates to electrophotographic imaging and, more particularly, relates to separate replaceable cartridges for toner and photoconductor, which are pressed together for good operation when installed in the imaging device.

### BACKGROUND OF THE INVENTION

Electrophotographic toner cartridges are often joined in two sections pivoted to one another so that a developer roller can be pressed against a photoconductor drum with controlled pressure. The controlled pressure is provided by permanently installed springs stretching between the two sections. The two sections are not normally separated, so such cartridges can be said to be one part cartridges.

Such one part cartridges have the advantage of having the spring force installed at the factory manufacturing the cartridge and having a relatively short duration during which the springs need provide the correct pressure, since the entire cartridge is refurbished (or discarded) after use of the original cartridge. Such one-piece cartridges have the disadvantage that the springs must be included on each cartridge. Also, for such one piece cartridges, replacement of the toner with a new section having the toner is not practical since the sections are not readily separated.

Two part cartridges are known in which a part having the toner is readily separated from a part having the photoconductor drum, since they are not pivoted to one another. To install such two part cartridges for imaging, they are manually brought together by the operator, and then the operator activates a latching mechanism, such as a resilient latch or a lever of some kind, to force the two parts together with the appropriate pressure for imaging.

A disadvantage of such known two part cartridges is that the forcing mechanism must be on one or both of the two parts and therefore adds to supplies costs, as both of the two parts are typically replaceable as they are worn (in the case of the photoconductor and other physical parts) or expended (in the case of the toner). Another disadvantage is that operator involvement requires training or some skill, and requires an overall design which permits the operator to reach the latching mechanism and activate it or deactivate it. A further disadvantage is that the force biasing elements require some space in the body of the imaging device.

### DISCLOSURE OF THE INVENTION

This invention provides for two part cartridges which have no mechanism to latch the cartridges together. Biasing force during use is provided from the cover of the imaging device when closed. The two parts need only have conforming external configurations so that they fit together, and require no space in the middle of the printer for a force biasing element. No operator involvement in forcing the two parts together is required except for inserting the cartridges in the imaging device and closing the cover of the imaging device. Although the biasing by the cover may be by a spring or springs more costly than springs or other forcing mechanism which might be on the parts, over the life of the imaging device the overall costs typically will be less.

### BRIEF DESCRIPTION OF THE DRAWINGS

The details of this invention will be described in connection with the accompanying drawings, in which

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FIG. 1 is a perspective view from the right of the two parts of the cartridge separated;

FIG. 2 is a side view from the left with covers removed showing selected parts of the two parts of the cartridge in contact when being forced together by the cover of the printer;

FIG. 3 is a side view from the right of the two parts of the cartridge forced together;

FIG. 4 is a side view from the left of the two parts of the cartridge separated;

FIG. 5 is a side view from the left of the two parts of the cartridge forced together;

FIG. 6 is a perspective view from the left showing the inside of the cover of the printer;

FIG. 7 is a perspective view of the cover like the view of FIG. 6 with a housing deleted to fully show the spring mounting;

FIG. 8 is a side view from the left sectioned in the middle of the cover showing the cover open and the cartridge parts installed in the printer; and

FIG. 9 is a side view as in FIG. 8 showing part 5 with the cover pivoted to its final position in which it is applying a force by contacting on the toner part of the cartridge.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a replaceable cartridge part 1 containing a photoconductive drum 3 (shown in FIG. 2) is shown separated from a replaceable cartridge part 5 containing a developer roller 7 and toner (not shown). The right side of part 1 has an upper guide channel 9 ending in a flat section 11 having a rear wall 13. The right side of part 1 also has a lower guide channel 15. Planar member 16 is a guide for installation in a printer.

The right side of part 5 has an upper guide stud 17 and a lower guide stud 19. FIG. 3 shows the two parts 1 and 5 forced together in accordance with this invention. Guide stud 17 fits in channel 9 but does not reach wall 13. Similarly, guide stud 19 fits in channel 15. Channels 9 and 15 direct the guide studs 17 and 19 respectively to bring developer roller 7 in contact with photoconductor drum 3 (FIG. 2).

Part 5 has an upper handle 21, which can be readily grasped by an operator to pull part 5 away from part 1. Part 1 has a lower handle 23 which extends past part 5 when the two are combined (FIG. 2). Handle 21 and handle 23 can be grasped and pulled by an operator to pull out part 1 and part 5.

Since part 5 contains toner used for imaging, part 5 will be extracted and replaced with a replacement part 5 having toner more frequently than part 1 will be replaced. Part 1 will be extracted and replaced with a replacement part 1 when the photoconductor becomes deteriorated or when excess toner fills the compartment in part 1 for toner cleaned from the photoconductor 3 (such cleaning is standard).

Referring to FIG. 4, the two parts 1 and 5 are shown from the left side separated. Part 1 has a guide channel 30 ending in a flat section 32 having a rear wall 34. Part 5 has a guide stud 36. The cover of part 1 has an opening 38 to provide external access to driven coupling 40 when part 5 is pressed against part 1 (FIG. 5). Planar member 42 is a guide for installation in a printer, as is standard.

The action of the drive coupling and the gears shown will not be described in detail as they are essentially standard for

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imaging by driving known parts, not shown, including a toner adder roller and a toner mixing paddle, as well photoconductor drum 3 and the developer roller 7. Similarly, with reference to FIG. 2, spring 46 biasing a change roller 48 against photoconductor 3 is standard and will not be further discussed.

FIG. 5 shows parts 1 and 5 from the left forced together in accordance with this invention. Guide stud 36 fits in channel 30 but does not reach wall 34. Channel 30 directs stud 36 to bring developer roller 7 in contact with photoconductor drum 3 (FIG. 2). Driven coupler 40 is located in opening 38 (FIG. 4) for access by a printer drive coupler (not shown).

Guide studs 17, 19 and 36 are external caps of DELRIN 500 polyacetal, a hard plastic, mounted on shafts integral with the body of part 5. The body of part 5 is made of polystyrene. Openings 17a, 19a (FIG. 1) and 36a (FIG. 4) permit flexing of the shafts. The DELRIN polyacetal caps have a circumferential groove which meshes with small, radial tongues (not shown) extending into the grooves of the caps to thereby form studs 17, 19 and 38. The caps are free to rotate, but they may simply slide without loss of important function with respect to this invention. Alternative materials and construction of studs 17, 19 and 36 could be readily employed.

Referring to FIG. 6, the inside of printer cover 50 is shown, which may be made of a standard, strong plastic. Mounted on opposite sides of cover 50 are pivot arms 52a and 52b, having near their ends pivot studs 54a and 54b. Pivot studs 54a and 54b enter frame F (FIG. 8) of the printer (only frame of printer illustrated in this description) to define fixed pivot points of cover 50 relative to the frame F.

Mounted on the inside of cover 50 is one-piece housing 56, mounted to cover 50 by four screws, 58a-58d. Housing 56 has latching members 60a and 60b on opposite sides of cover 50. Primarily significant to this invention, housing 50 confines a leaf spring 62, having opposed bent ends 62a and 62b which extend past housing 56 at openings 56a and 56b on opposite sides of cover 50.

Housing 56 has integral, upward extending arms 57a-57d, which contact cover extensions 50a-50d. Screws 58a-58d are located in lateral, oval slots in housing 56. Integral with housing 56 on the left is a flat, pressing surface or "button" 64. When cover 50 is closed, latching members 60a and 60b are pushed leftward by arms 57a-57d acting on extensions 50a-50d. An operator pushing on button 64 overcomes this force and frees latches 60a and 60b to allow cover 50 to open.

FIG. 7 is the same view as FIG. 6 with housing 56 and its integral parts deleted so as to better show spring 62 and its mounting. In this embodiment, spring 62 is a single leaf spring held against cover 50 by two screws 70a, 70b located at the center of spring 62. Spring 62 is held against undue movement away from cover 50 by spaced ledge members 72a, 72b on cover 50. Spring 62 is confined from undue movement laterally by the extensions 72aa and 72bb holding ledge members 72a and 72b and by upper and lower spaced ledges 74a, 74aa and 74b and 74bb. Mounting posts 76a-76d receive screws 58a-58d (FIG. 6).

FIG. 8 shows cover 50 open and the full cartridge of parts 1 and 5 in its installed position on the printer, illustrated as frame elements F. The installed parts are held against further movement away from cover 50 by being blocked by frame F.

FIG. 9 omits cartridge part 1 to better illustrate cartridge part 5. Part 5 is also in the installed position as shown in FIG.

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8. In this position part 5 has a substantially vertical front wall 70. Upon closing of cover 50, the ends 62a and 62b encounter front wall 70 of cartridge part 5 and press it against part 1. As discussed with respect to FIG. 8, the installed cartridge parts 1 and 5 are held against movement away from door 50 by frame members of the printer. Latch members 60a and 60b flex part ledges (not shown) in the frame F and then latch over the ledges.

#### Variations and Alternatives

Although spaced spring contacts as in the foregoing embodiment tend to minimize variations between printers from differences within accepted tolerance, clearly a single leaf spring mounted in the center is an alternative. Of course, two spaced coil springs is an alternative. Other members can provide resilience, such a urethane rubber pads. Instead of spaced contacts, a wide, resilient pad could provide the force biasing. In sum, this invention is not deemed limited by the details of the biasing member operating from the cover. The cover could provide a linkage to move a separated biasing member with movement of the cover, although this normally would be more expensive than simply mounting the biasing member on the cover.

A modification of the foregoing under consideration is to replace spring 62 by two, separate leaf springs, each originating near the middle of cover 50 and terminating as shown in the foregoing.

Although the cover in the foregoing embodiment opens from the bottom, a clear alternative would be to hinge the cover on the bottom so that it opens from the top.

Other variations and alternatives will be readily apparent or can be anticipated.

What is claimed is:

1. An imaging device having a two part imaging cartridge installed in said imaging device, said imaging device having a cover movable from open to closed positions containing a force biasing member, said force biasing member contacting one of said two parts when said cover is closed to force said two parts together for imaging operation:

wherein said two parts have no force biasing member on either part for force biasing said two parts together for imaging operation.

2. The imaging device as in claim 1 in which one of said two parts contains a developer member and the other of said two parts contains a photoconductor and said forcing said two parts together forces said developer member and said photoconductor member together.

3. The imaging device as in claim 1 in which one of said parts has at least one guide channel and the other of said parts has a guide stud which is in said guide channel when said two parts are installed.

4. The imaging device as in claim 2 in which one of said parts has at least one guide channel and the other of said parts has a guide stud which is in said guide channel when said two parts are installed.

5. A two part imaging cartridge in which one part is in contact with the other part by at least one guide stud on one of said two parts entering at least one guide channel on the other of said two parts, one of said two parts containing a developer member and the other of said two parts containing a photoconductor, said guide channel being directed to bring said developer member in contact with said photoconductor and having an open end for said entry of said guide stud,

wherein said two parts have no force biasing member on either part for force biasing said photoconductor against said developer member, force biasing for imag-

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ing being dependent upon external force being applied to said two parts.

6. The two part imaging cartridge of claim 5 in which one of said parts has at least one guide channel and the other of

**6**

said parts has a guide stud which is in said guide channel when said parts are in said contact.

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U.S. PATENT: 6,816,692

ISSUE DATE: November 09, 2004

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T. LAWRENCE  
Certifying Officer



US006816692B1

(12) **United States Patent**  
**Kerley et al.**

(10) **Patent No.:** **US 6,816,692 B1**  
(45) **Date of Patent:** **Nov. 9, 2004**

(54) **SUPPORT ASSEMBLY FOR ROLLER INCLUDING ROLLER BODY AND SUPPORT SHAFT**

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(73) Assignee: **Lexmark International, Inc.**, Lexington, KY (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/442,816**

(22) Filed: **May 21, 2003**

(51) Int. Cl.<sup>7</sup> ..... **G03G 15/00**

(52) U.S. Cl. .... **399/222; 399/119**

(58) Field of Search ..... 399/222, 119, 399/120, 279, 313, 328, 110

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*Primary Examiner*—Quana Grainger

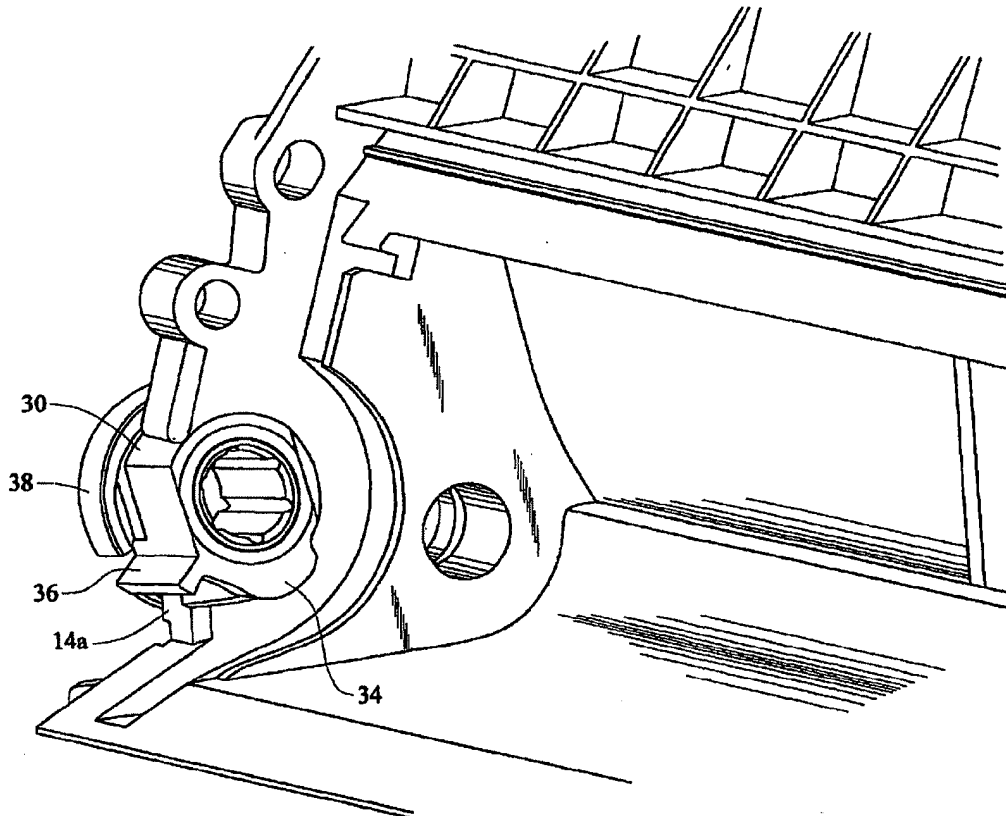
(74) *Attorney, Agent, or Firm*—John A. Brady

(57)

**ABSTRACT**

Gear (52) and resin body (2) supported on shaft (1) and between frame members (14a) and (14b) are protected from contacting a frame member. Frame (14a) has a partial hole (22) with an opening (24) and a cavity (26), which is open at the hole (22) and on the side toward the opening (24). A bearing (18) has an inner body (30) which internally is partially circular with diameter substantially the same as opening (22). The outer portion of body (30) forms an outwardly extending nub (34). Wall (36) extends across body (30). The part (38) of bearing 18 opposite body 30 has an extended part (38a) to serve as an electrical contact. A shaft end (5a) past a circular ledge (3a) is supported by bearing (18). The nub (34) fits in the cavity (26) and the wall (36) defines the proper position of rotation of the bearing. This protects gear (52) from being dislodged from its position on shaft (1). Where the resin body (2) is for electrophotographic developing, toner carried by the body (2) is not subject to effects from the body contacting a frame element or the like.

**13 Claims, 6 Drawing Sheets**



**A4380**

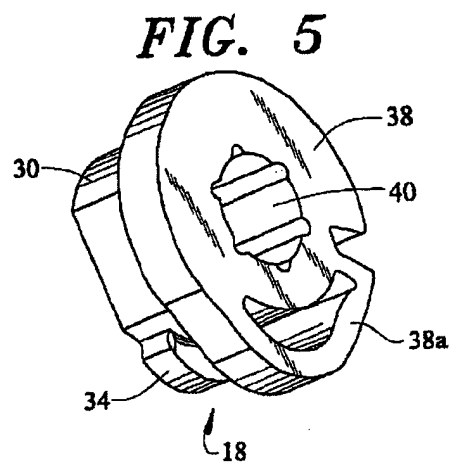
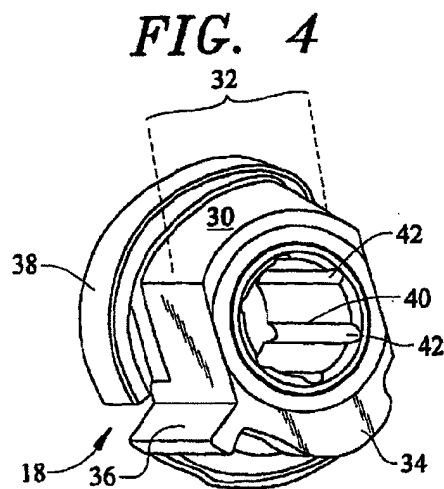
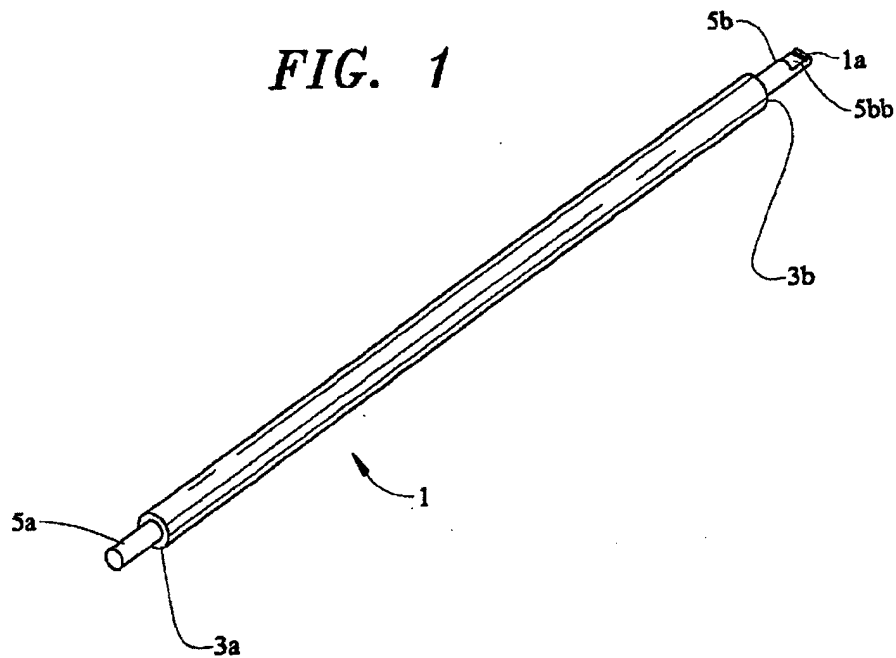
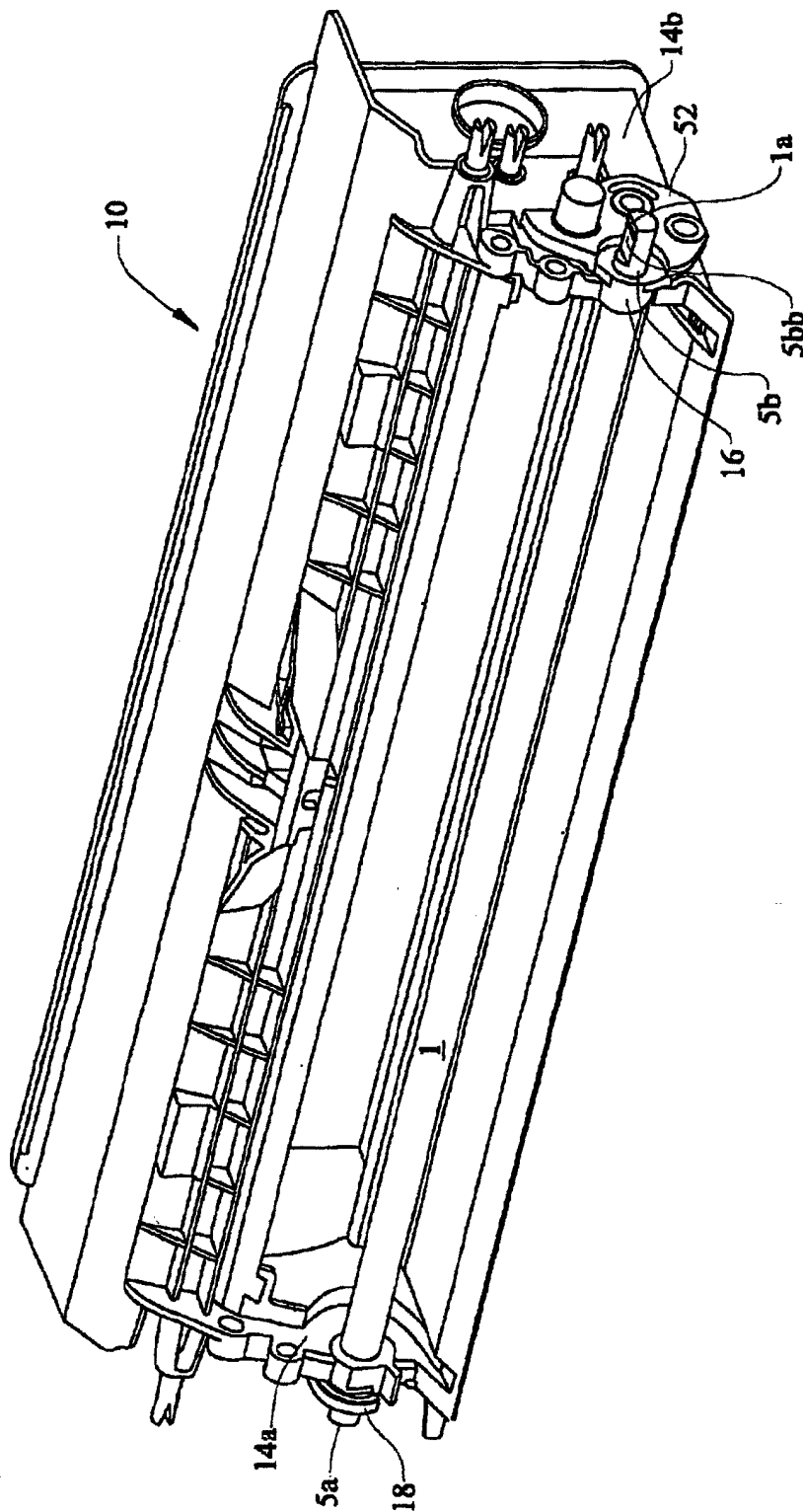




FIG. 2



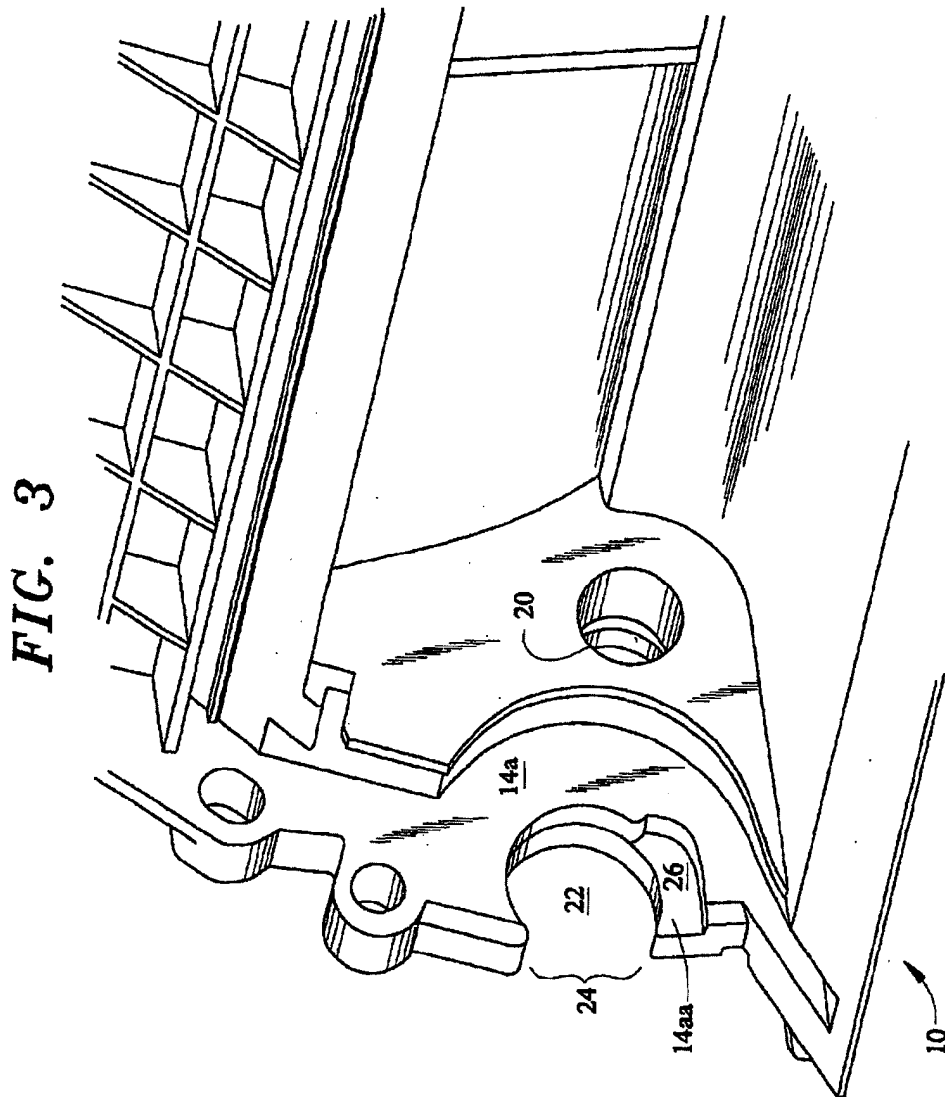


FIG. 6

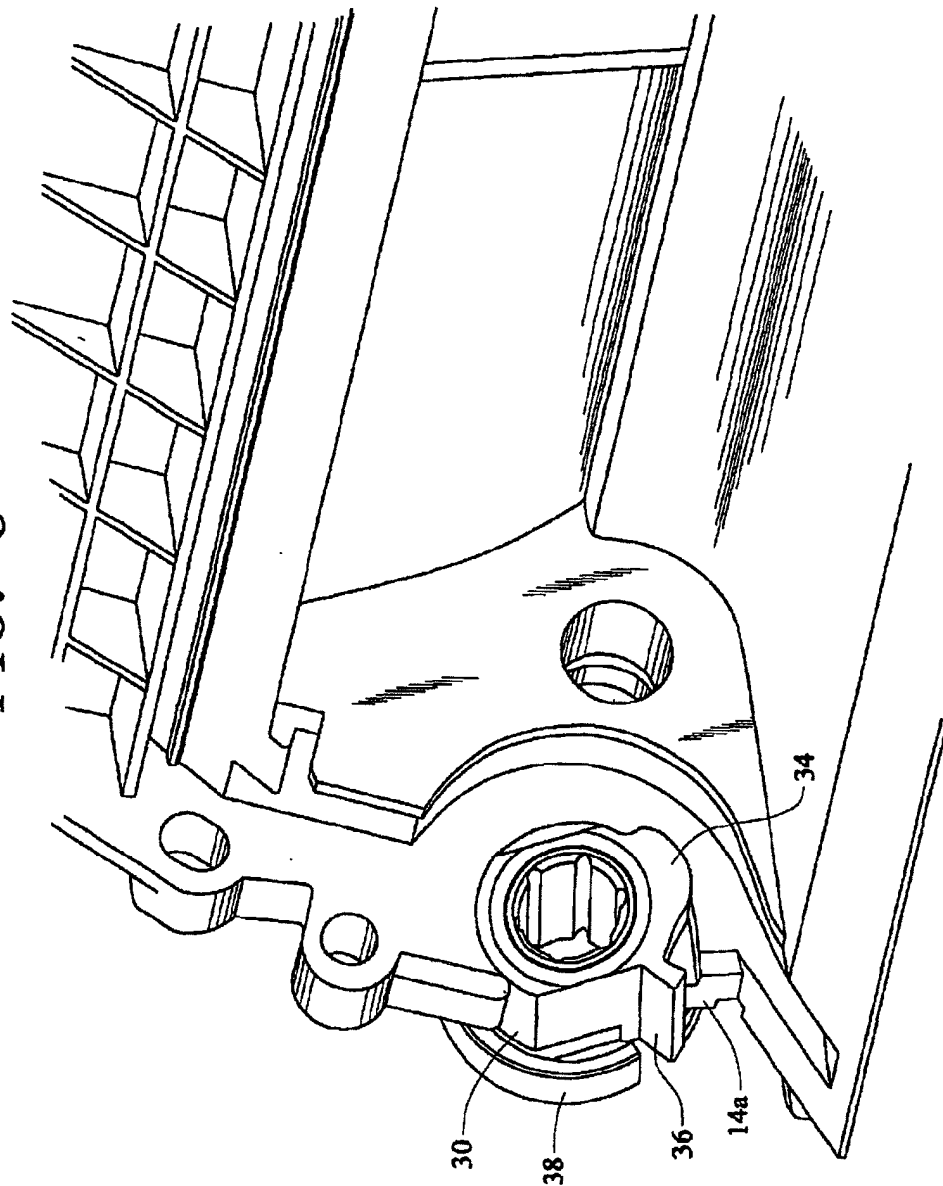


FIG. 7

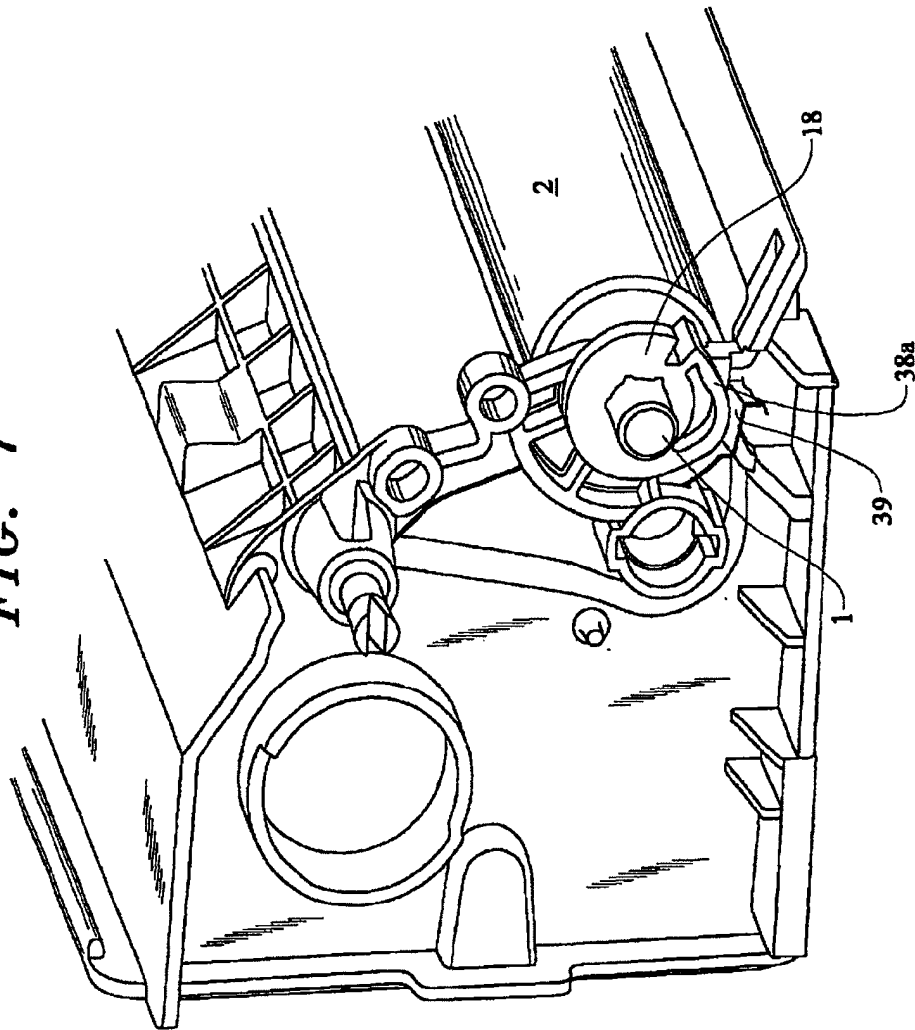
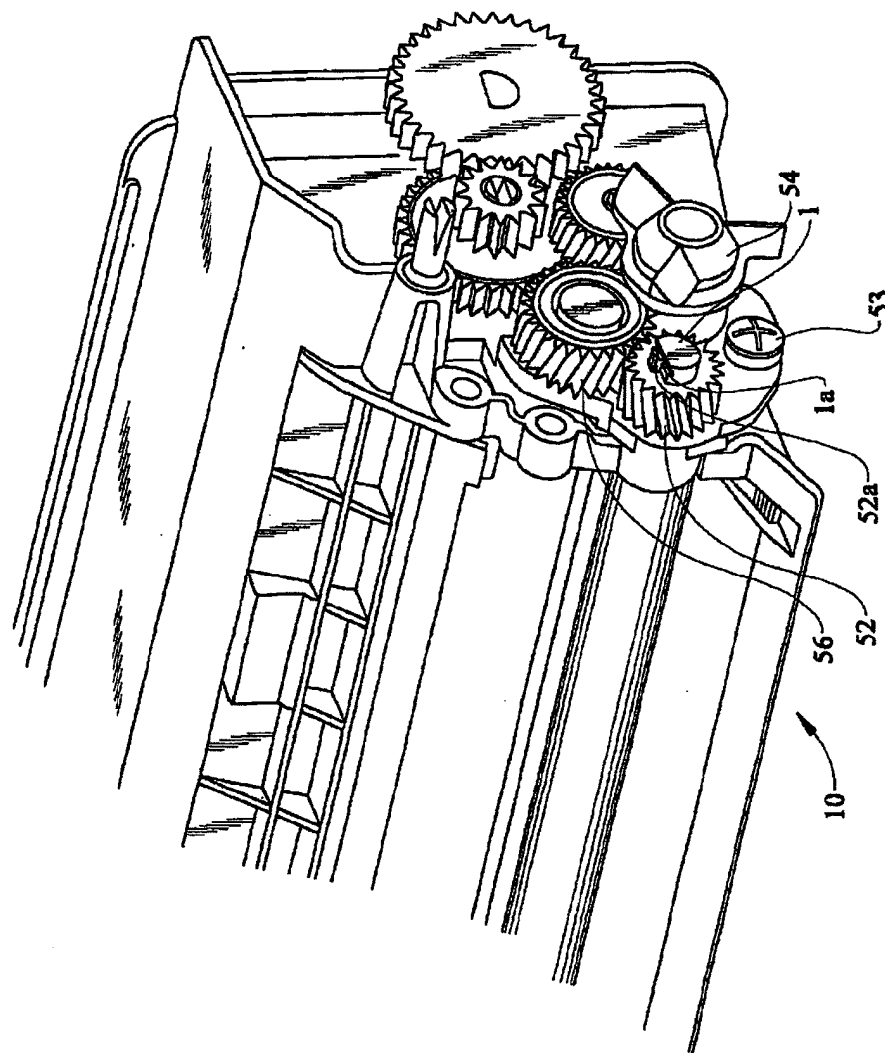


FIG. 8



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# **SUPPORT ASSEMBLY FOR ROLLER INCLUDING ROLLER BODY AND SUPPORT SHAFT**

## **TECHNICAL FIELD**

This invention relates to mounting rollers, such as electrophotographic developer rollers, to be protected from being damaged or deformed by lateral forces. Such forces may come from drive forces employing helical gears or from external impact such as being dropped.

## **BACKGROUND OF THE INVENTION**

Rollers such as electrophotographic developer rollers are relatively pliable cylindrical masses mounted on a steel shaft. (The cylindrical mass will be termed here the "roller body.") The steel shaft is inherently resistant to deformation. Deformation of the roller body by lateral forces can cause the support frame to impact gears mounted on the shaft, which can destroy the gear operation. Additionally, deformation of the roller body by lateral forces results in uneven development and escape of toner out of the electrostatic device, both events being unacceptable.

Prior rollers are known which provide a circular ledge in the support shaft on each side of the support shaft. The roller body is located between the ledges. The ledges, as well as edges of the roller body contact the frame. This can be acceptable where the gear on the shaft is press fit and can be moved slightly when dropped, and where toner escape is prevented by the frame being sufficiently stiff.

A prior assembly for preventing lateral forces on the roller body is understood to provide a notch for a C clip spaced a short distance from the ledge at each ledge. The notches are positioned immediately past the frame holding the roller, so that the C clip in each notch prevents significant lateral movement by abutting the frame. (The frame at this location normally includes a bearing in which the shaft is inserted.) The shaft is held in one lateral direction by one of the C clips abutting the frame and the shaft is held in the other lateral direction by the other C clip abutting the frame.

Such an assembly, however, does not protect a gear mounted on the shaft when the frame deflects so much that a C clip is displaced. Similarly, such an assembly does not protect the roller body when the frame deflects so much that the roller body comes in contact with the frame or another element on the side of the assembly. Moreover, it is desirable to eliminate the C clips, as they are separate elements having some cost and some potential of failure and are difficult to repair.

## **DISCLOSURE OF THE INVENTION**

In accordance with an implementation of this invention a ledge is provided on each side of the roller shaft. On one end of the shaft the ledge abuts the frame element to protect the roller body from lateral movement in one direction in the manner of the ledge in of the foregoing prior assembly. A unique, first bearing and frame combination is provided to receive the shaft on the other end of the shaft. The first bearing has a small width and a larger width, the larger width having an extended part. The frame has an opening to allow the bearing to enter when the small width faces the opening and has a cavity to receive a part of the larger width when the bearing is rotated. The cavity has an outer wall that is part of the frame.

The first bearing has a central hole in which the shaft is inserted. The opposite end of the shaft is inserted into a

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conventional, second bearing in the frame on the side opposite to the first bearing. The second bearing may be conventional when it is in a stiff element such as a gear plate. With the shaft inserted, the first bearing is rotated so that its small width fits into the frame opening and is then inserted into that frame opening. Then the first bearing is rotated so that the extended part is in the cavity of the frame.

In this assembly both sides of the shaft abut the bearings, which are part of the frame. Therefore, the roller body is prevented from coming in contact with the frame.

In an embodiment, the shaft carries a helical gear, which is positively attached to the shaft, specifically by a snap fit on the gear that mates with a notch fitted into a ledge in the shaft. This positions the gear against movement by lateral forces caused by the helical gear design, which permits the gear assembly to be compact and carry large forces. The gear is prevented from being stripped out of the notch when the cartridge is subjected to large lateral forces by the shaft being firmly positioned with respect to the frame.

The first bearing preferably is electrically conductive and has an extended part on its outside past the frame for contact with an electrical contact pad in a cartridge in which the roller is mounted.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The details of this application will be described in connection with the accompanying drawings, in which:

FIG. 1 is the central support shaft having circular ledges on each end;

FIG. 2 is the mounting assembly of this invention in an electrostatic developer cartridge, with the roller body not shown so as to better illustrate of this invention.

FIG. 3 is the unique frame configuration of this invention;

FIG. 4 is a perspective view of the bearing of this invention from the inside of the developer cartridge when installed;

FIG. 5 is a perspective view of the bearing of this invention from the outside of the developer cartridge when installed

FIG. 6 shows the bearing installed from the inside of the developer cartridge;

FIG. 7 shows the bearing installed from the outside of the developer cartridge and shows the roller body; and

FIG. 8 illustrates the gear assembly, having a gear mounted on the shaft of the roller.

## **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

FIG. 1 shows the steel shaft 1, which supports a roller body 2 (FIG. 7) disposed around shaft 1 to form a developer roller. Roller body 2 is a resilient, polymeric material for which it is an aspect of this invention that roller body 2 is protected from lateral forces.

Shaft 1 has circular ledges 3a, 3b near each end of shaft 1 formed by the shaft being reduced to cylindrical end sections 5a, 5b. End section 5b has a flat end section 5bb to mesh with a gear 52 (FIG. 8). Shaft 1 differs from that of the prior assembly discussed in the foregoing essentially by having no notch for a C clip and by having a notch 1a for engagement with a drive gear snap.

FIG. 2 shows the shaft alone installed in a toner cartridge 10. (The full developer roller with shaft 1 and roller body 2 is shown in FIG. 7). The cartridge 10 carries a supply of electrostatic toner powder that is supplied to the roller body



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2 for application to a photoconductor drum (not shown). The opening 12 on the upper right is to support a bearing for a toner paddle. Such a system may be entirely conventional and therefore will not be discussed in detail.

Of direct interest with respect to this invention are the structural support elements of cartridge 10, including left wall 14a and right wall 14b, collectively known as the frame. Shaft is supported for rotation by right bearing 16, which is a round and cylindrical, and by left bearing 18, which is unique in accordance with this invention. Bearings 16 and 18 are held by side walls 14b and 14a respectively and therefore constitute part of the frame of cartridge 10. As is conventional, bearing 18 is a hard, smooth durable plastic, which provides a low-friction surface for shaft end 5a to be reliably positioned for rotation. Bearing 18 is a POM (polyoxymethylene) plastic carbon filled to be electrically conductive so as to provide an electrical potential to shaft 1 during use.

FIG. 3 illustrates the left wall 14a and surrounding areas without the bearing 18. Hole 20 is to receive a bearing to support a standard toner adder roller, which will not be discussed in further detail. Of direct interest is opening 22 in wall 14a having a circular perimeter except for a gap 24, and adjoining a cavity 26. Cavity 26 has a bottom and back surface extending into cartridge 10, but is open on where it faces hole 22 and on the front side. Cavity 26 has an outer wall 14aa on the side toward hole 22.

FIG. 4 shows bearing 18 from the side facing the interior of cartridge 10 when bearing 18 is installed on cartridge 10. Bearing 18 has two flat sides extending across an inner body 30 defining a narrow dimension 32. Remaining internal portions of inner body 30 define a circular perimeter. Dimension 32 is substantially the same size (equal to or somewhat less in size) to the width of opening 24 in hole 22 (FIG. 3). The circular perimeter of inner body 30 is substantially equal in diameter to or slightly greater than the diameter of the central portion of hole 22.

An outer portion of inner body 30 is an outwardly extending nub 34 that conforms in size and outer contour to cavity 26 (FIG. 3). Nub 34 is located generally between the flat sides of inner body 30. Bearing 18 has a wall 36 extending across inner body 30.

The outer body 38 of bearing 19 is generally circular, but has an extended part 38a (FIG. 5) to facilitate contact to an electrical contact pad 39 (FIG. 7). Finally, bearing 18 has a central hole 40 to receive shaft end 5a. Hole 40 is substantially equal in size to shaft end 5a. Hole 40 has narrow channels 42 to collect wear debris and contamination from toner and paper dust, as is conventional. FIG. 5 and FIG. 7 show bearing 18 viewed toward the side outside of cartridge 10 when installed. Extended part 38a presses against electrical contact pad 39 and thereby forms an electrical connection between pad and shaft. 1

To install bearing 18, the end 5a of shaft 1 is first inserted in hole 40. Bearing 18 is then turned until the flat dimension 32 of bearing 18 faces gap 24 with the nub 34 is positioned away from hole 22. Since dimension 32 fits within gap 24, bearing 18 can be moved into hole 22. When that is done, bearing 18 is then rotated to bring nub 34 into cavity 26 (counterclockwise as viewed from the FIG. 3 perspective). Wall 36 contacts the lower edge of hole 22 to define when the rotation is complete, which is when nub 34 occupies substantially all of cavity 26. Bearing 18 installed is shown from the inside of cartridge 10 without roller body 2 in FIG. 2 and is shown from the outside with the entire roller of shaft 1 and roller body 2 in FIG. 7.

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The side of cartridge 10 having bearing 16 carries the gear mounting plate 52. Plate 52 is a rigid plastic and firmly mounted to wall 14b, as by at least one screw 53 (FIG. 8). Therefore, plate 52 is much more rigid than opposite wall 14a. For that reason bearing 16 in this embodiment is a standard bearing having nothing corresponding to nub 34 fitting in a cavity in the frame. Bearing 16 is a cylindrical structure integral with plate 52 with inner hole that receives shaft end 5b surrounded by an outer surface against which ledge 3b abuts. Bearing plate 52, which includes bearing 16, is 30 percent glass filled Nylon 6/6 with 15 percent polytetrafluoroethylene.

FIG. 8 illustrates gear 52 mounted on shaft 1 where it extends past the frame of cartridge 10, as well as other gears forming a gear assembly in this embodiment. Gear 54 receives a driving from the device (not shown) in which the cartridge 10 is mounted. Such force is transmitted through gear 56 to gear 52. Gears 52, 50 and 54 are helical gears. As the gear assembly shown is quite compact and requires a relatively strong drive force on element 54, gear 52 can not be held by a press fit. Instead, gear 52 is positively attached by a tab member 52a integral with gear 52. Tab member 52a presses by its natural resilience into notch 1a of shaft 1 (also FIG. 2). This invention prevents gear 52 from being displaced from the position of FIG. 8 because no element of the frame of cartridge 10 can contact gear 52.

Alternatively, bearing 16 may be a separate member having flats to form a narrow dimension as discussed in connection with bearing 18, and installed through a gap in the manner of bearing 18. Such a flat dimension and installation through a gap is known. As another alternative, bearing 16 could be a mirror image version of bearing 18 (except without extension 38a as unnecessary), with plate 52 or other frame member having a cavity corresponding to cavity 26.

In accordance with this invention, forces impacting cartridge 10 rightward as viewed by the drawings will tend to force roller body 2 into wall 14a. Instead, however, ledge 3a in shaft 1 contacts bearing 18, which moves as part of the frame. Bearing 18 moves with wall 14a by force from nub 34 abutting wall 14aa of cavity 26. Roller body 2 necessarily remains spaced from contact with any frame element or the like. Also, shaft 1 is prevented by wall 14a from moving enough to displace gear 52.

A wide variety of alternative structures can carry out this invention so long as they provide an abutment that requires the bearing to move laterally with lateral movement of the frame and a ledge on the shaft abutting the bearing.

What is claimed is:

1. An assembly to support a roller having a roller body and a support shaft comprising:

- a frame having a partially circular hole having an open side said hole having a first diameter where said hole has opposite sides, said frame having a cavity having an open side facing said hole and an open side facing said open side of said hole and an outer wall contiguous to said hole;
- a first bearing held in said hole, said first bearing having a partially circular center portion of diameter substantially the same as said first diameter, said first bearing having an outer nub extending past said diameter of said central portion, said nub being positioned in said cavity so as to abut said outer wall contiguous to said hole when moved in the direction of said hole; and
- a supporting shaft carrying a roller body disposed around said supporting shaft, said supporting shaft having a

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first end portion held for rotation on said first bearing and a first ledge, said first ledge being located to abut said first bearing, said supporting shaft having a second end portion held for rotation is a second bearing opposite said first end portion and a second ledge, said second ledge being located to abut said second bearing.

2. The assembly as in claim 1 in which said first bearing is electrically conductive and has an extended part for contacting an electrical contact member.

3. The assembly as in claim 2 in which said first bearing has a wall extending across said center portion of said first bearing to locate said nub in said cavity.

4. The assembly as in claim 3 in which said first bearing has sides forming a portion narrower than said first dimension which fits in said opening of said frame to permit insertion of said first bearing in said frame and said nub is located generally between said sides of said portion narrower than said first dimension.

5. The assembly as in claim 3 in which said supporting shaft has a part extending past said frame and a gear is mounted to and positively attached to said part extending past said frame.

6. The assembly as in claim 2 in which said first bearing has sides forming a portion narrower than said first dimension which fits in said opening of said frame to permit insertion of said first bearing in said frame and said nub is located generally between said sides of said portion narrower than said first dimension.

7. The assembly as in claim 2 in which said supporting shaft has a part extending past said frame and a gear is

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mounted to and positively attached to said part extending past said frame.

8. The assembly as in claim 1 in which said first bearing has a wall extending across said center portion of said first bearing to locate said nub in said cavity.

9. The assembly as in claim 8 in which said first bearing has sides forming a portion narrower than said first dimension which fits in said opening of said frame to permit insertion of said first bearing in said frame and said nub is located generally between said sides of said portion narrower than said first dimension.

10. The assembly as in claim 8 in which said supporting shaft has a part extending past said frame and a gear is mounted to and positively attached to said part extending past said frame.

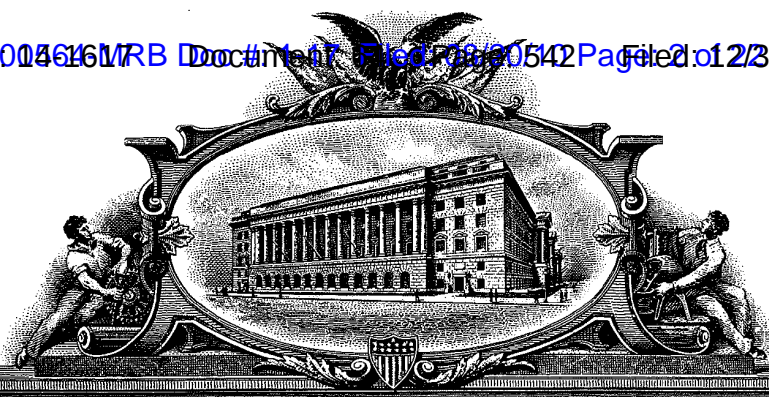
11. The assembly as in claim 1 in which said first bearing has sides forming a portion narrower than said first dimension which fits in said opening of said frame to permit insertion of said first bearing in said frame and said nub is located generally between said sides of said portion narrower than said first dimension.

12. The assembly as in claim 11 in which said supporting shaft has a part extending past said frame and a gear is mounted to and positively attached to said part extending past said frame.

13. The assembly as in claim 1 in which said supporting shaft has a part extending past said frame and a gear is mounted to and positively attached to said part extending past said frame.

\* \* \* \* \*

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# THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office

January 04, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: 6,871,031

ISSUE DATE: March 22, 2005

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



T. LAWRENCE  
Certifying Officer



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(12) **United States Patent**  
**Blaine et al.**

(10) **Patent No.:** **US 6,871,031 B2**  
 (45) **Date of Patent:** **Mar. 22, 2005**

(54) **COUPLING MECHANISM FOR A TWO  
 PIECE PRINTER CARTRIDGE**

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(\*) Notice: Subject to any disclaimer, the term of this  
 patent is extended or adjusted under 35  
 U.S.C. 154(b) by 40 days.

(21) Appl. No.: **10/393,066**

(22) Filed: **Mar. 20, 2003**

(65) **Prior Publication Data**

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(51) Int. Cl.<sup>7</sup> ..... **G03G 21/18**

(52) U.S. Cl. .... **399/113**

(58) Field of Search ..... **399/111, 113,**  
**399/116, 119**

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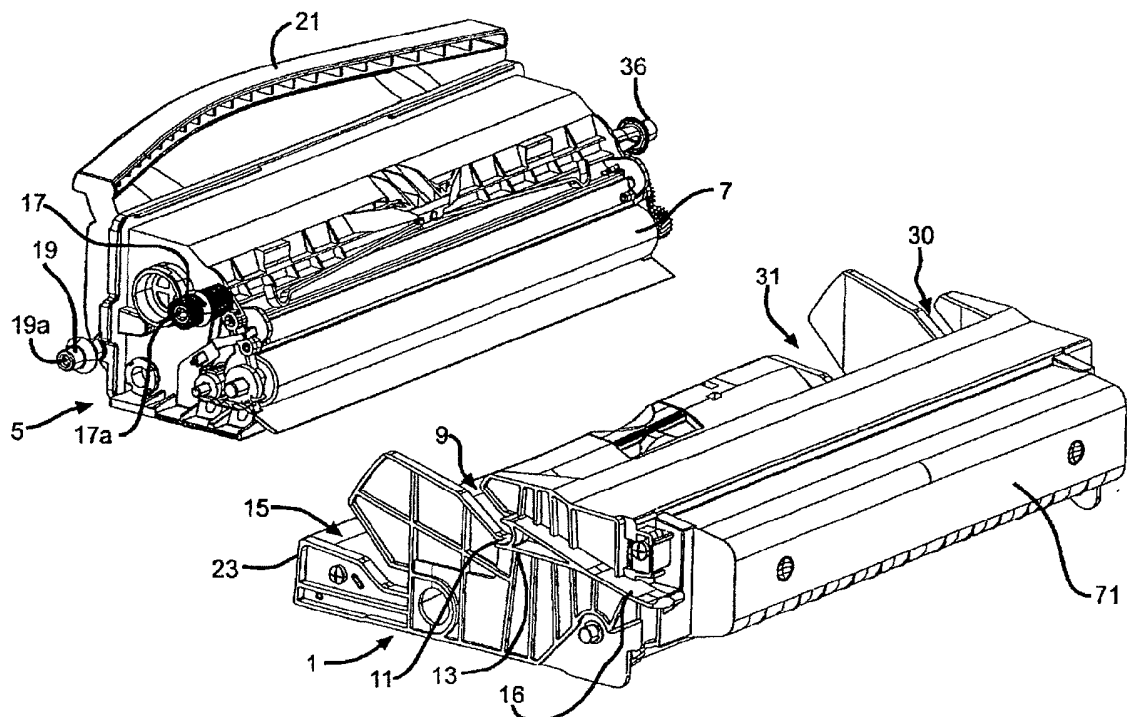
*Primary Examiner*—Robert Beatty

(74) *Attorney, Agent, or Firm*—Lexmark International, Inc.

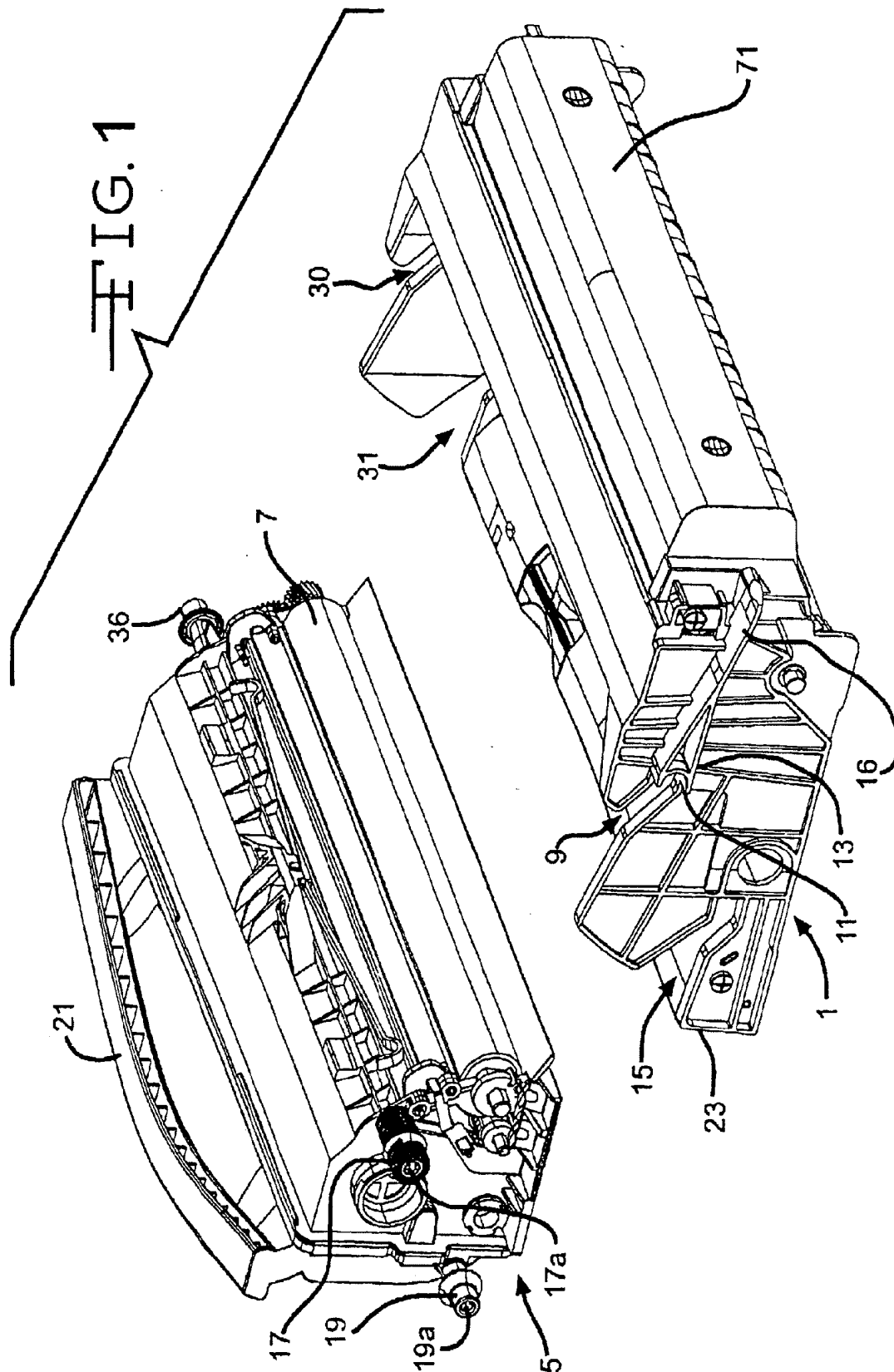
(57) **ABSTRACT**

In a two piece toner cartridge assembly, as typically used in a computer and/or facsimile printing device, comprising separable photoconductor and developer units a unique coupling device is provided whereby the cartridge assembly may be removed from the printing device without the photoconductor unit separating from the developer unit for paper jam clearance or unit replacement. However, if desired the developer unit may be separately removed from the printing device for servicing or replacement without removal of the photoconductor unit.

**12 Claims, 15 Drawing Sheets**







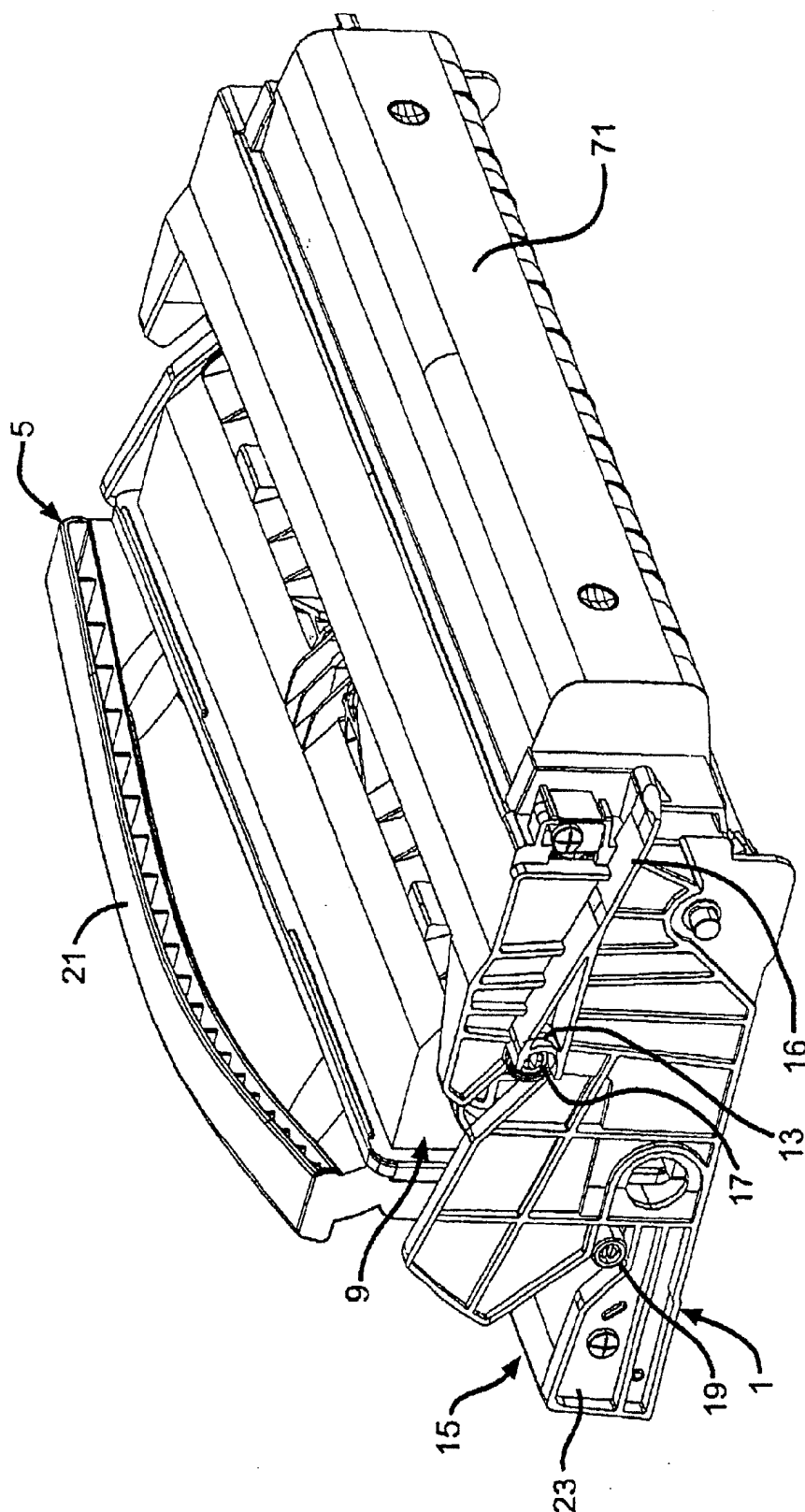


FIG. 2



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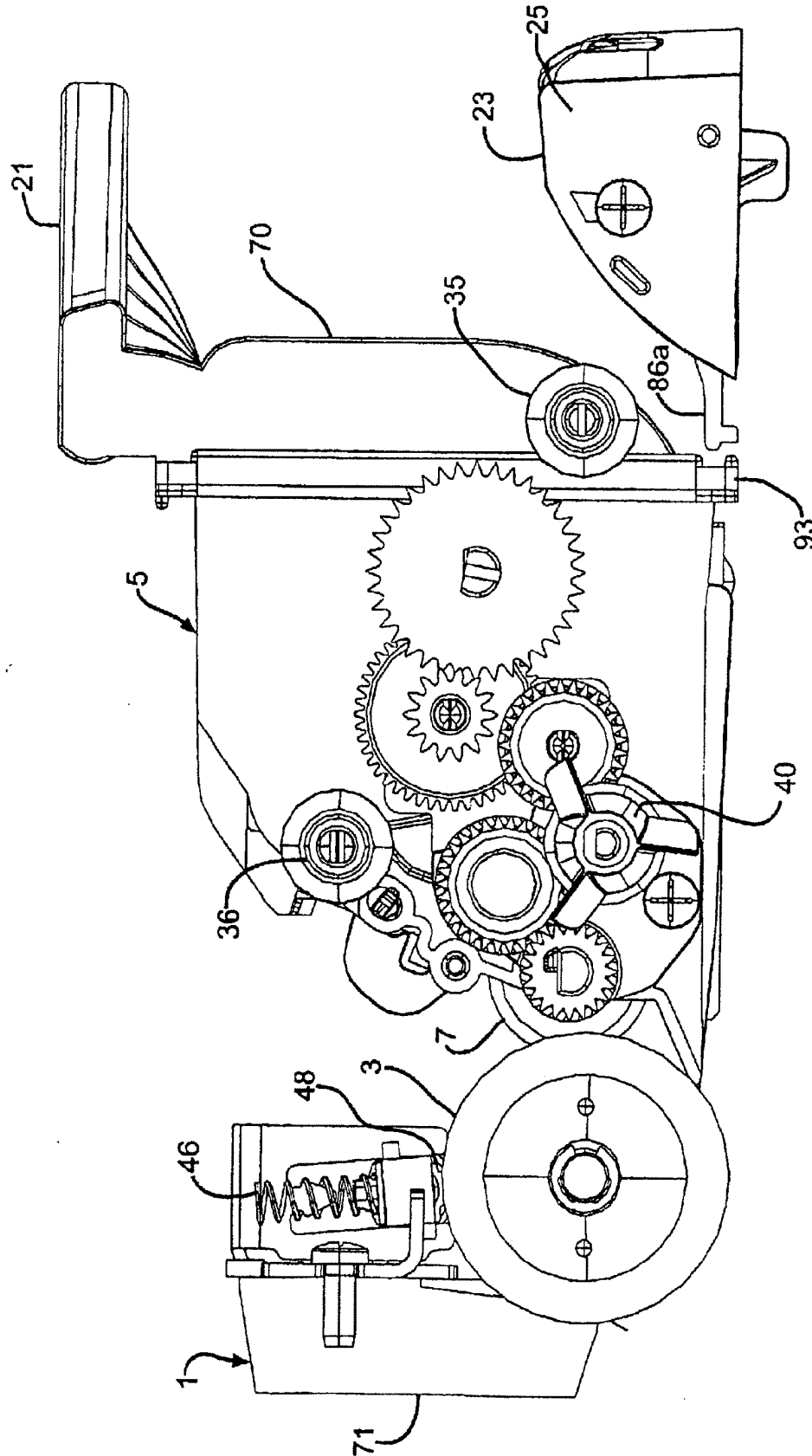


FIG. 3



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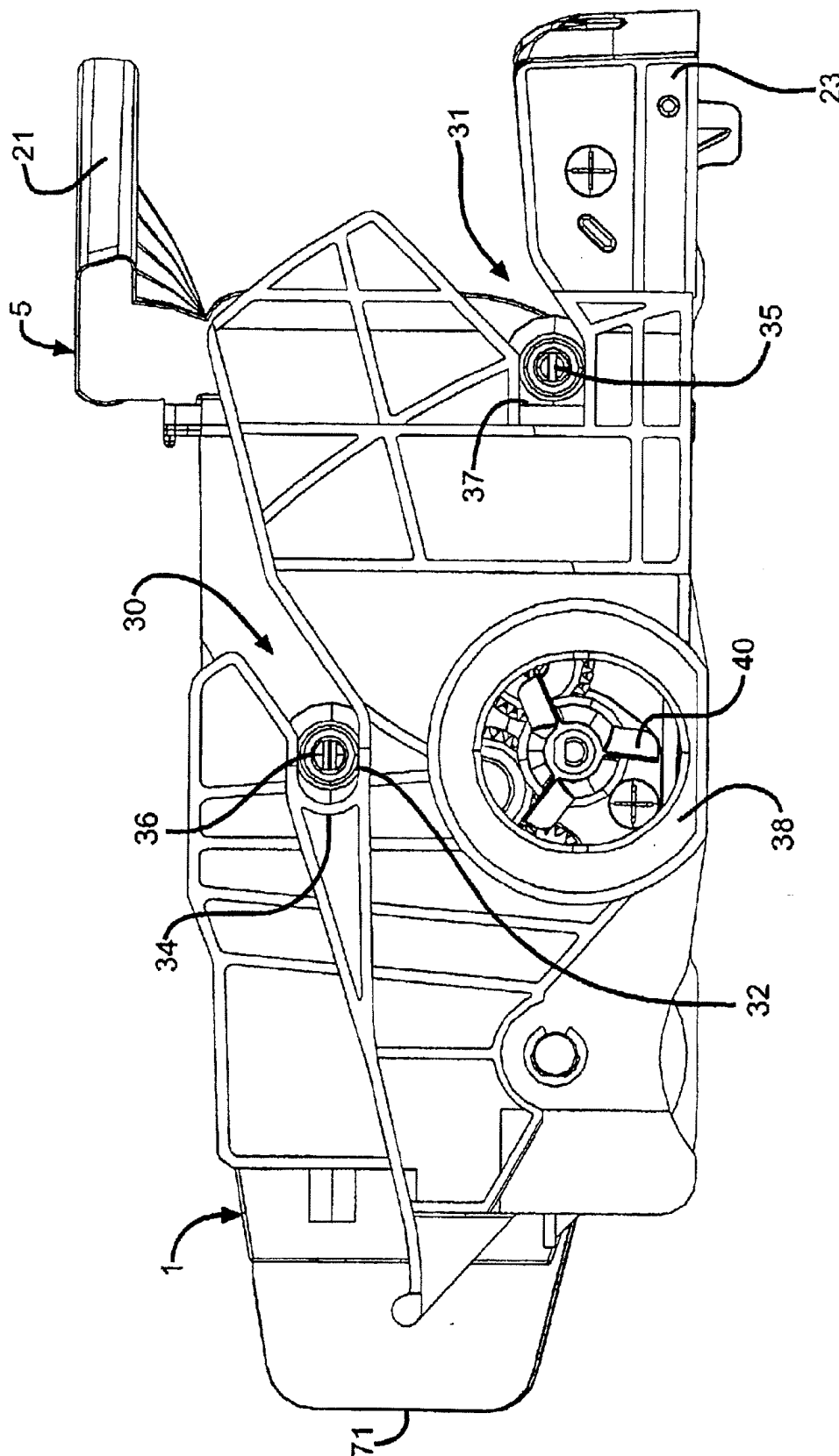
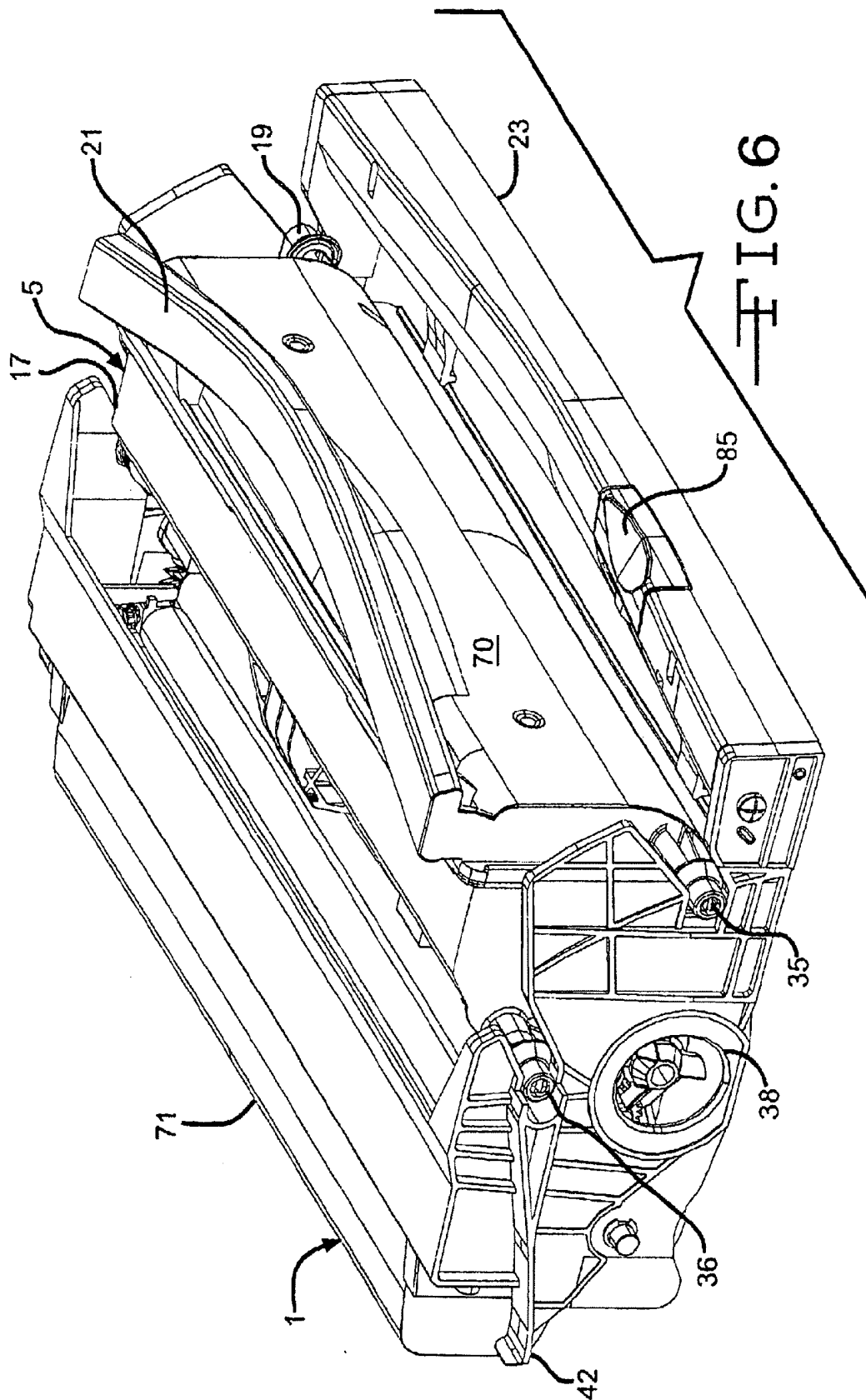
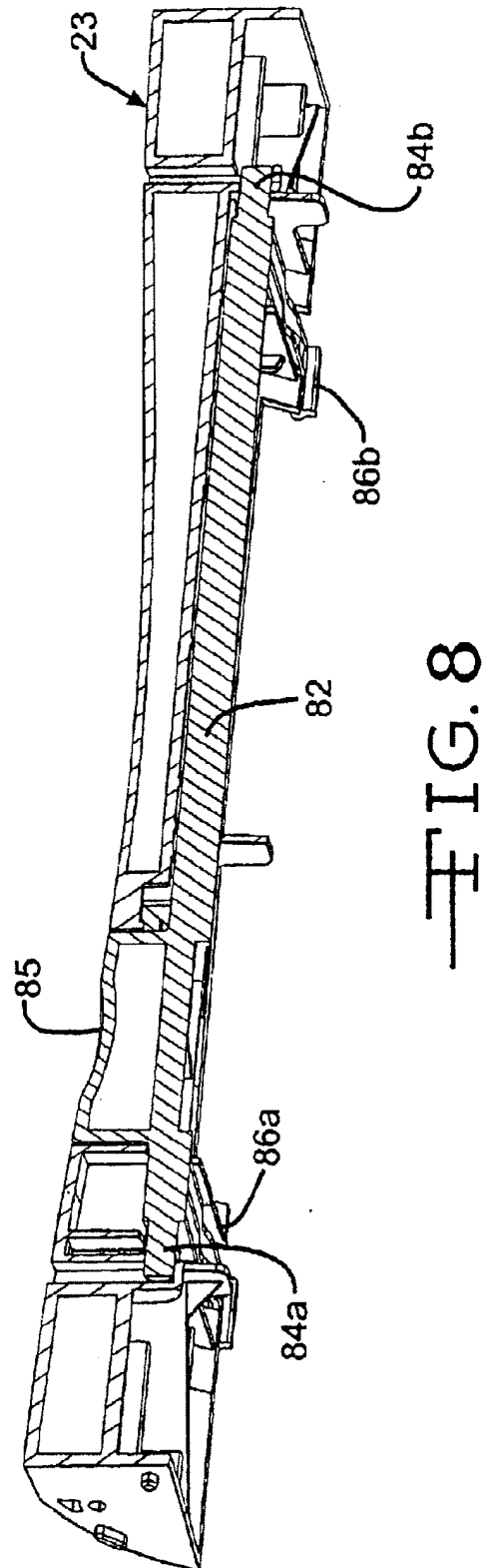
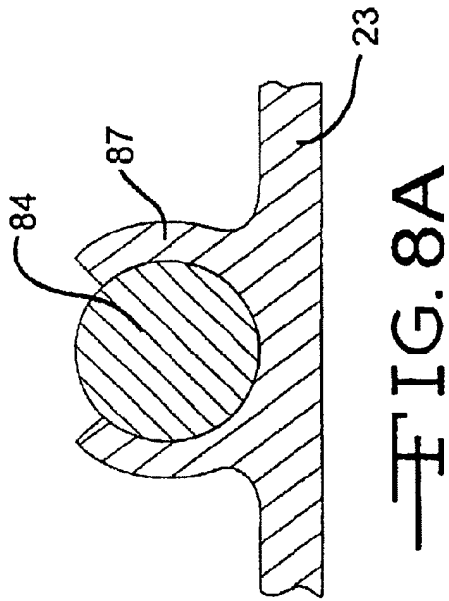


FIG. 5







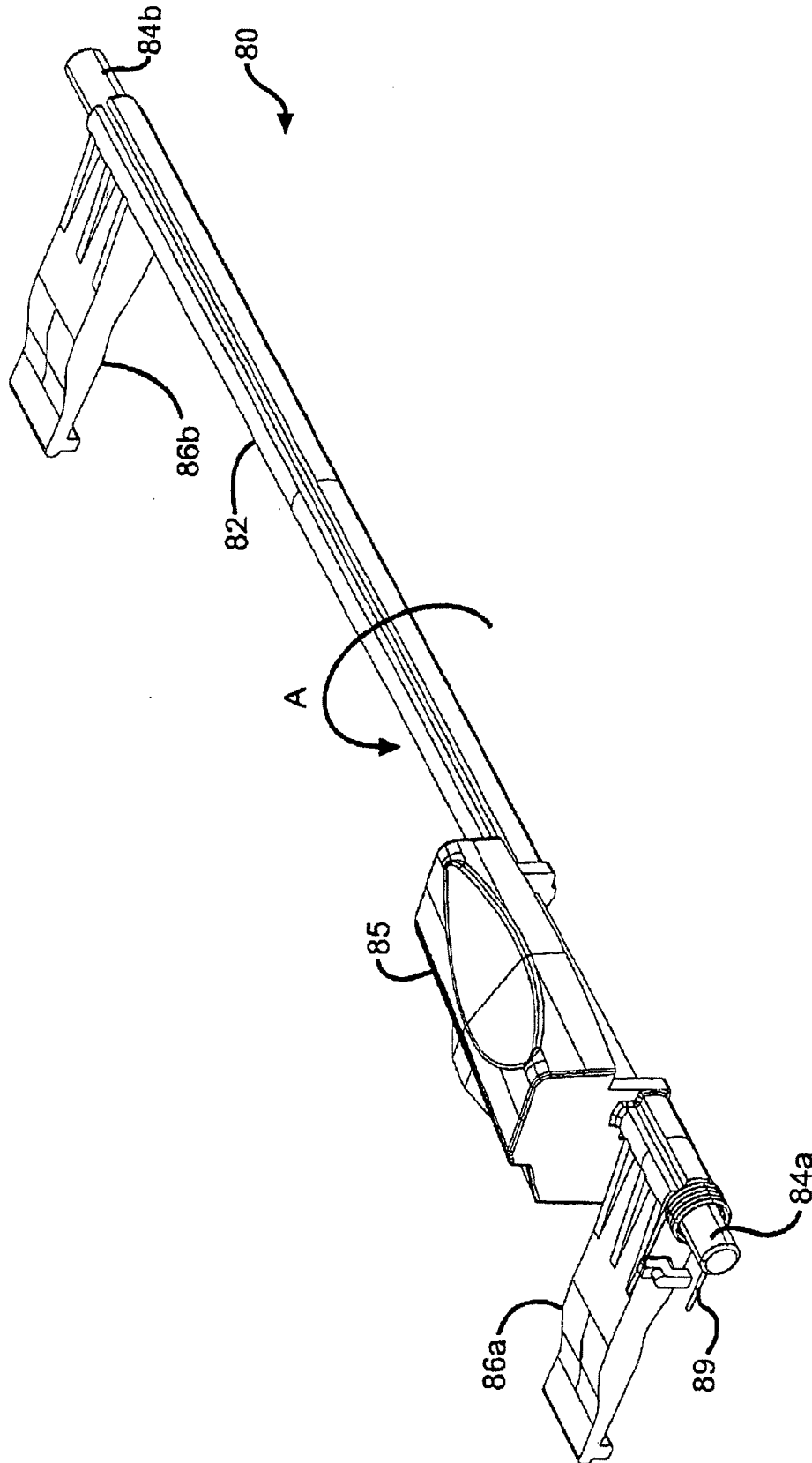


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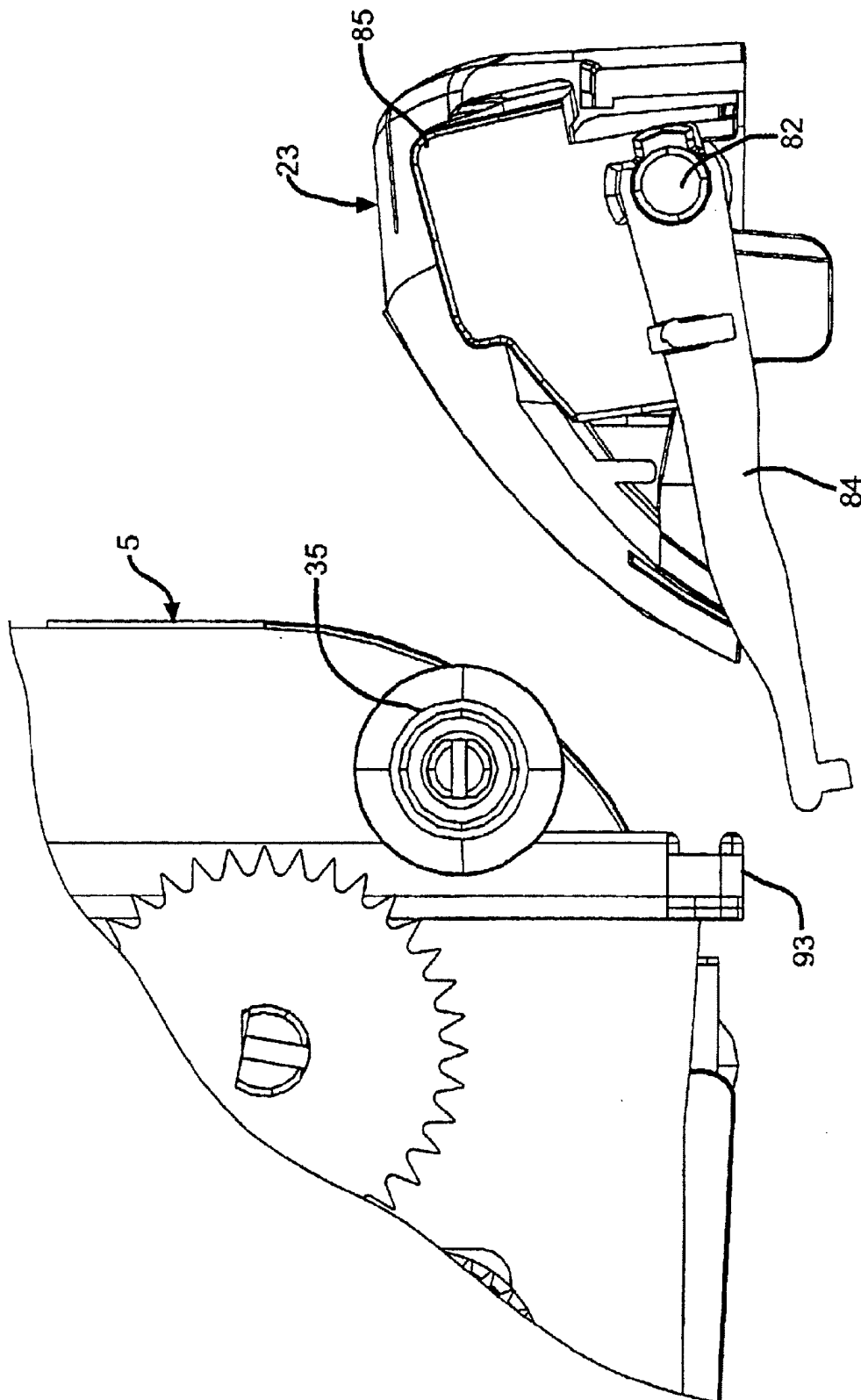


FIG. 10

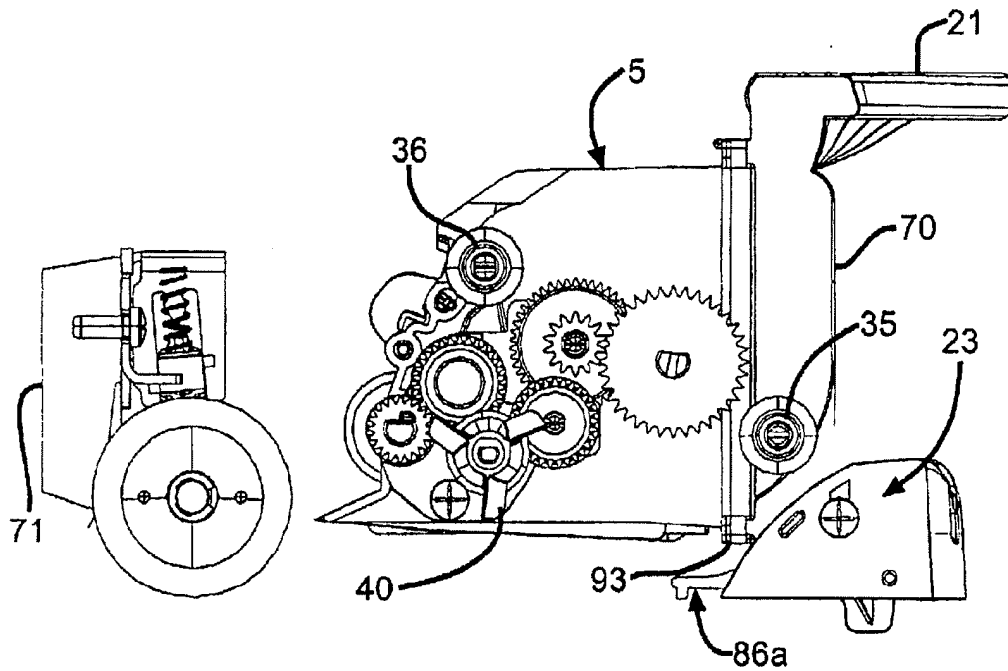


FIG. 11

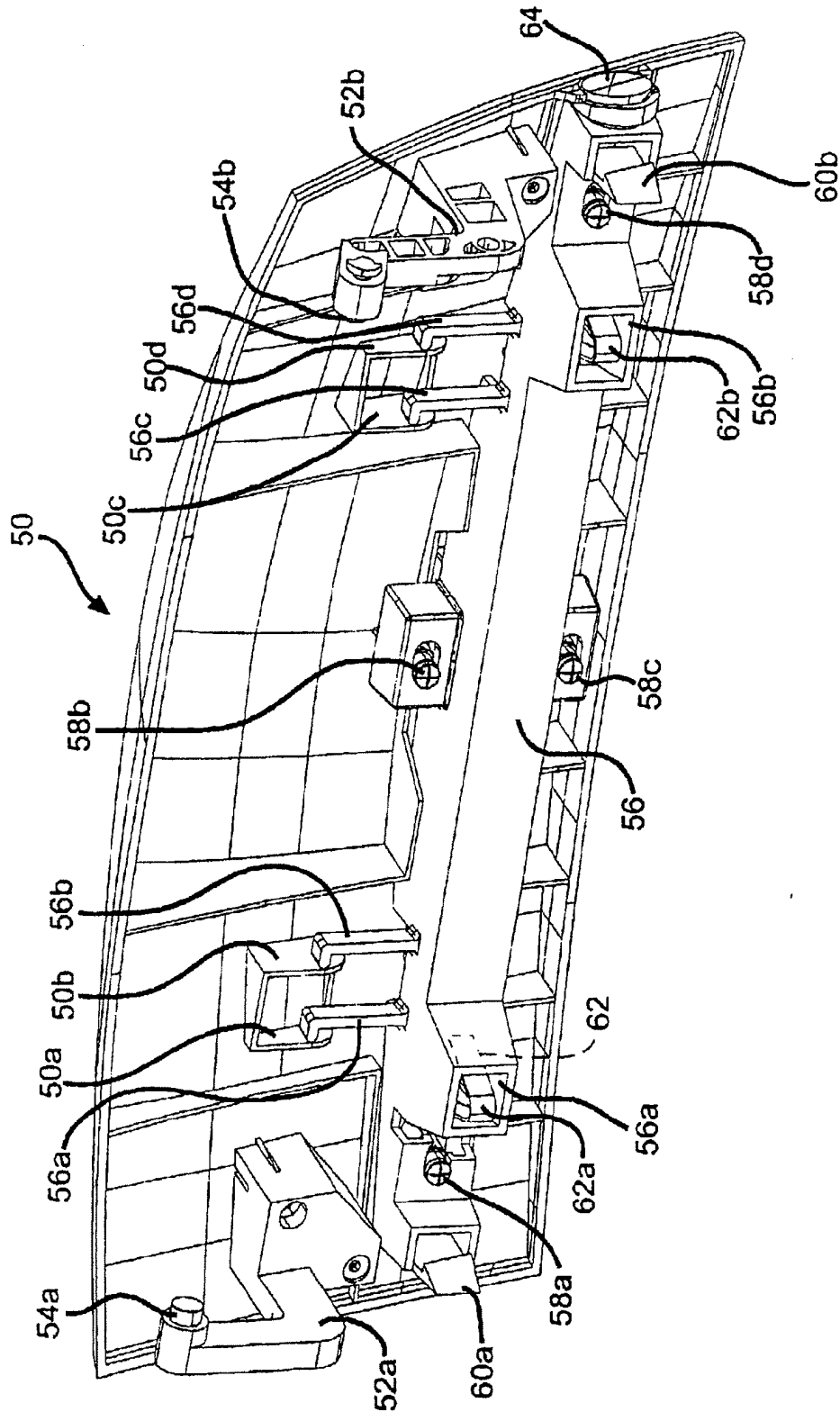


FIG. 12

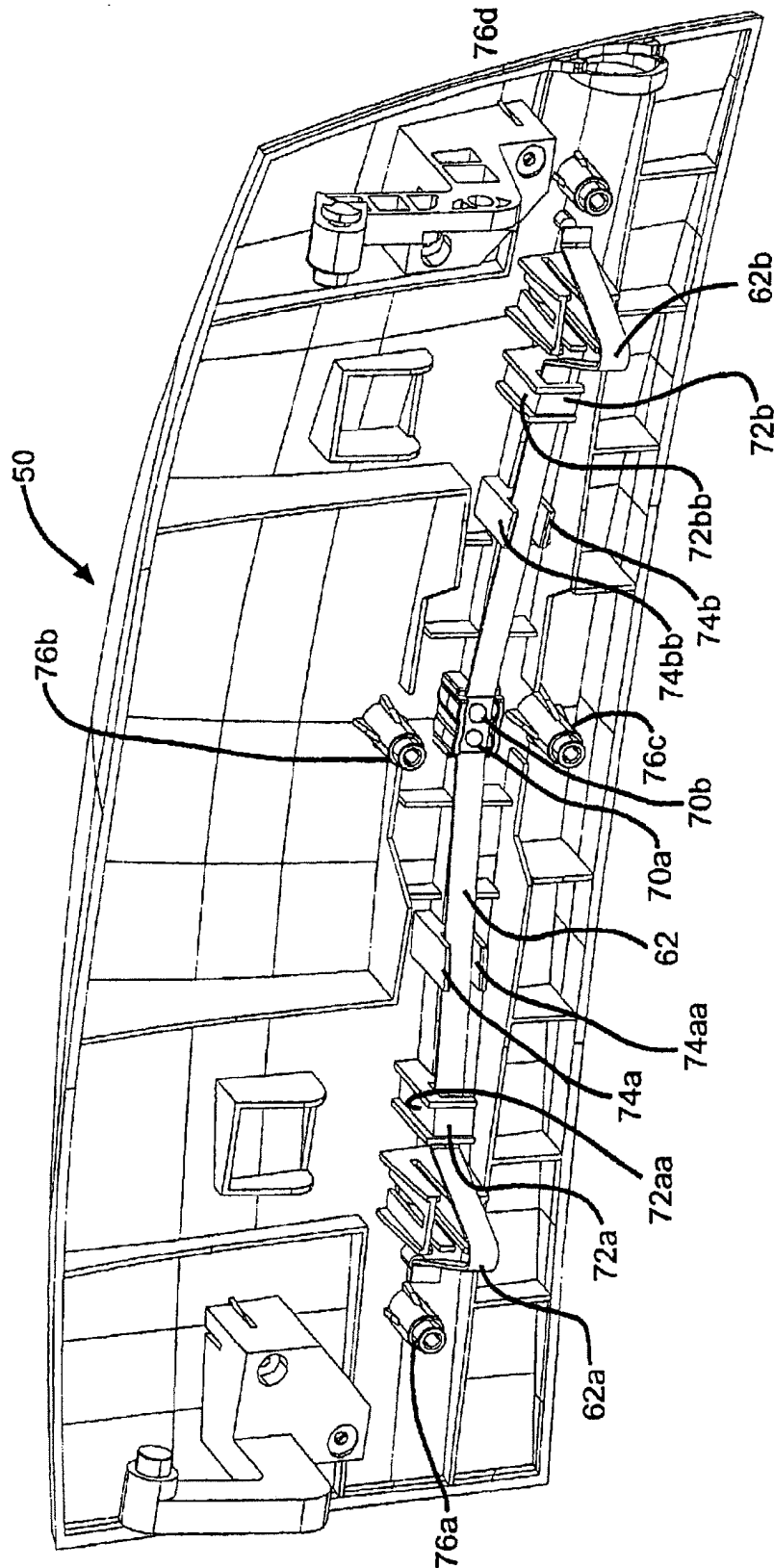


FIG. 13





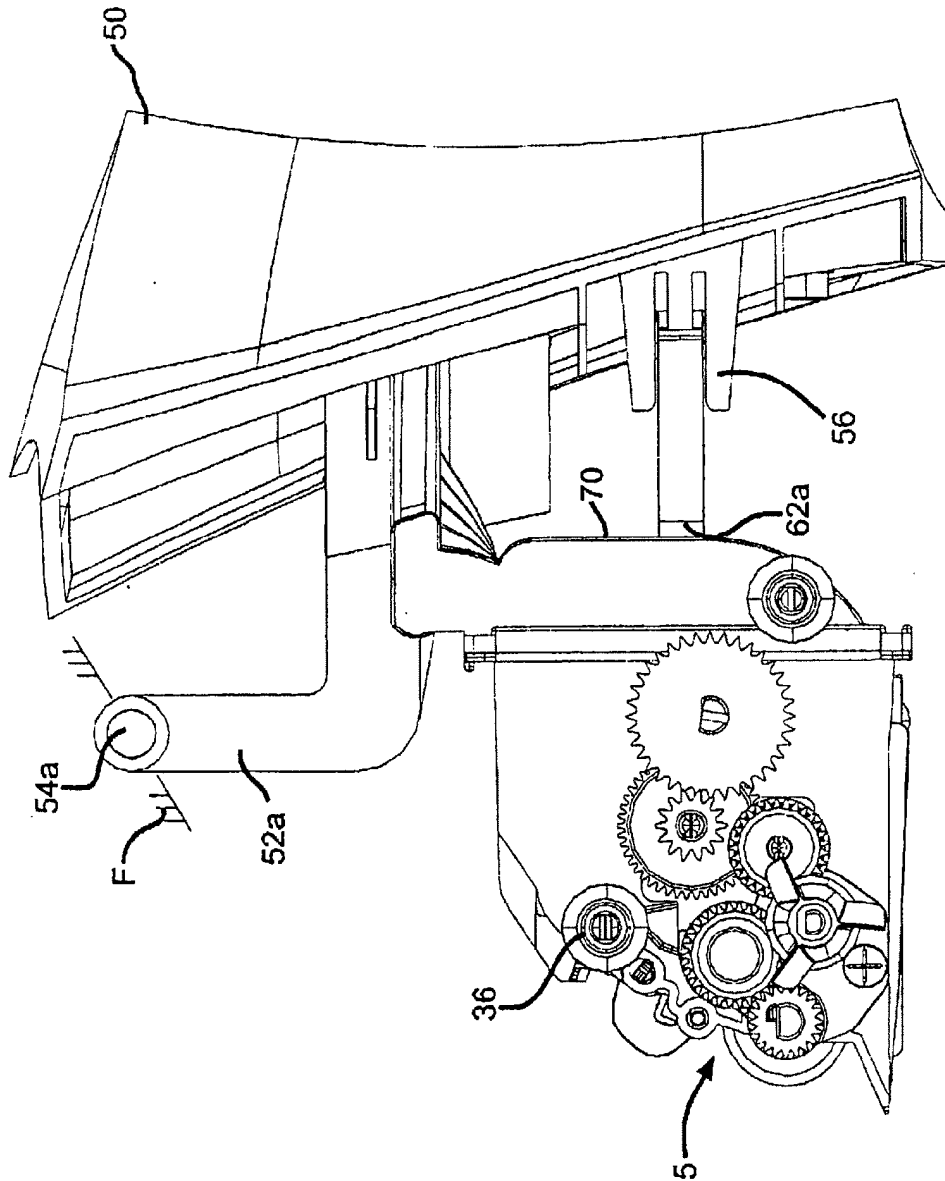


FIG. 15

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## COUPLING MECHANISM FOR A TWO PIECE PRINTER CARTRIDGE

### TECHNICAL FIELD

The present invention generally relates to electrophotographic imaging devices and, more particularly to a two piece printer cartridge assembly having a separately replaceable developer and a photoconductor, which are typically biased together when installed in an imaging device such as a computer printer or facsimile machine. More specifically, the present invention relates to a blocking mechanism whereby the two piece cartridge may be removed as a combined assembly from the imaging device, or the developer unit, having the toner supply therein, may be singly removed for replacement by the user without having to remove the photoconductor.

### PRIOR ART

Heretofore electrophotographic toner cartridges were of the unitary type typically including a developer section and a photoconductor section connected to one another so that the developer roller, of the developer, is pressed against the photoconductor drum, of the photoconductor, with a predetermined and controlled pressure. The controlled pressure is often provided by permanently installed springs stretching between the two units such that the two units are not separable, thereby forming a unitary or one piece replaceable cartridge.

Such one piece toner cartridges have the advantage of having the springs installed at the factory manufacturing the cartridge and since the springs have a relatively short operational life, the entire cartridge may be factory refurbished (or discarded) upon depletion of the toner supply whereupon new springs may be installed. However, such one-piece cartridges have the disadvantage that biasing springs must be included in each cartridge assembly thereby increasing the cost of manufacture and/or refurbishing. Also, for such one piece cartridges, replacement, by the user, of the toner section only, with a new toner section, is not practical since the units are not readily separated.

However, two piece cartridges are known in which the developer unit, having the toner, is readily separated from the photoconductor unit. When such two piece cartridges are installed in a typical printing device, they are manually brought together, by the user, and interconnected by a latching mechanism, such as a resilient latch, lever, or springs of some sort, whereby the two units are drawn together with the required pressure between the developer roll and the photoconductor roll for satisfactory imaging.

A disadvantage of such prior art cartridge assemblies is that the pressure applying mechanism must be installed on one or both of the units and therefore adds to supply costs, as both of the assemblies are typically replaceable as they are worn, as in the case of the photoconductor unit, or expended, as in the case of the developer unit.

A further disadvantage of the prior art two piece cartridge, is that such user involvement requires training and/or skill, on the part of the user, and requires an overall structural design which permits the user to easily reach the latching mechanism, between the two units, and activate or deactivate it. A further disadvantage is that the force biasing elements require space within the body of the imaging device.

### SUMMARY OF THE INVENTION

The present invention provides for an easily separated two piece toner cartridge assembly, comprising a developer unit

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and a photoconductor unit which requires no force biasing mechanism between the developer unit and the photoconductor unit. The biasing force mechanism urging the developer unit and the photoconductor units together, with the desired pressure for use, is provided by the front cover of the imaging device, within which the toner cartridge is inserted, when the front cover, of the imaging device, is in the closed operational position. The developer and photoconductor units need only have conforming external configurations wherein they fit together requiring no interior space within the imaging device for accommodating a force biasing mechanism to urge the developer and photoconductor units together. No user involvement is necessary for urging the developer and photoconductor units together except for inserting the units into the imaging device and closing the cover of the imaging device. Although the biasing mechanism provided by the cover may comprise a spring or springs more costly than springs or other forcing mechanism which might be otherwise provided between the developer unit and the photoconductor unit, over the life of the imaging device the overall costs will typically be less.

A novel feature of the two piece toner cartridge taught herein comprises a blocking mechanism whereby the developer unit and the photoconductor unit may be locked together and removed from the imaging device as a unitary assembly or the developing unit may be unlocked from the photoconductor unit and singly removed from the imaging device for servicing or replacement. A blocking lever is provided within the handle of the photoconductor unit which, although not being in a physical latched relationship with the developer unit, nevertheless functions as a physical obstructing barrier preventing separation of the developer unit from the photoconductor unit when the blocking lever is in the blocking position thereby allowing removable of the photoconductor unit from the imaging device with the developer unit intact. To separate the developer unit from the photoconductor unit, the blocking lever is repositioned to an unlocked position, thereby permitting the developer unit to be separated from the photoconductor unit.

Thus by the present invention, a two piece toner cartridge may be removed from an imaging device and handled as a unitary assembly, or the two units may be easily separated from one another for separate servicing.

### BRIEF DESCRIPTION OF THE DRAWINGS

The details of this invention will be described in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view showing the two piece toner cartridge having the developer unit separated from the photoconductor unit in accord with the present invention.

FIG. 2 is a perspective view of the two piece toner cartridge having the photoconductor unit and the developer unit assembled in accord with the present invention.

FIG. 3 is a left side view with covers removed, showing selected elements of the photoconductor and developer units of the two piece toner cartridge as an operating assembly with the blocking arms in their default, locked position.

FIG. 4 is a left side view showing the photoconductor and developer units separated from one another.

FIG. 5 is a left side view of the photoconductor and developer units assembled in accord with the present invention.

FIG. 6 is a reverse angle perspective view of FIG. 2 showing the photoconductor and developer units assembled in accord with the present invention.

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FIG. 7 is a perspective view of the photoconductor unit separated from the developer unit.

FIG. 8 is a sectional view taken along line 8—8 in FIG. 7.

FIG. 8A is a partial schematic view of a typical method of attaching the unit blocking assembly to the photoconductor unit handle.

FIG. 9 presents a perspective view of the unit blocking assembly removed from the photoconductor handle.

FIG. 10 is a partial left side view showing the blocking arms in their release position.

FIG. 11 is a left side view, similar to FIG. 3, showing the developer unit being removed from the photoconductor unit.

FIG. 12 is a perspective view showing the inside of the printer front cover.

FIG. 13 is a perspective view of the printer front cover, similar to the view in FIG. 12, with a housing deleted to fully show the pressure spring mounting.

FIG. 14 is a left side view showing the printer cover, sectioned in the middle, illustrating the cover in the open position and the assembled toner cartridge as installed in a typical printer.

FIG. 15 presents a left side view, similar to that in FIG. 14, showing the printer cover pivoted to its final closed and operating position wherein the cover is applying a lateral force upon the developer unit thereby biasing the developer and photoconductor units together in accord with the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1, presents a pictorial view of a two piece cartridge assembly illustrating the developer unit 5 separated from the photoconductor unit 1. Developer unit 5 includes the developer roller 7 and toner (not shown). The right side of photoconductor unit 1 includes an upper guide channel 9 ending in a flat section 11 having a rear wall 13. The right side of photoconductor unit 1 also includes a similar, lower guide channel 15. Planar member 16 is a guide for installation of photoconductor unit 1 within a printer. Similarly the left side of photoconductor unit 1 includes an upper guide channel 30 and a lower guide channel 31.

The right side of developer unit 5 includes an upper guide stud 17 and a lower guide stud 19. Similarly the left side of developer unit 5 includes an upper guide stud 36 and a lower guide stud 35 as best illustrated in FIG. 4. FIG. 2 illustrates the photoconductor unit 1 and the developer unit 5 assembled in their normal working configuration. Guide stud 17 fits within channel 9 but does not reach wall 13. Similarly, guide studs 19, 35 and 36 fit within channels 15, 31 and 30 respectively. Thus channels 9, 15, 30 and 31 engage guide studs 17, 19, 36 and 35 respectively, (see FIGS. 2, 5, and 5a) thereby bringing developer roller 7 into an aligned contact with photoconductor drum 3 as illustrated in FIG. 3.

Developer unit 5 also includes an upper handle 21, which can be readily grasped by the user to separately remove developer unit 5 from engagement with photoconductor unit 1. Photoconductor unit 1 is also provided with a lower handle 23 which extends slightly beyond developer unit 5 when the two units are combined as illustrated in FIGS. 3, 5 and 6. Included within handle 23 is a blocking mechanism 80, as illustrated in FIGS. 8 and 9 whereby developer unit 5 is blockingly restrained within photoconductor unit 1. Thus handle 23, or handle 21, may be grasped by the user to

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remove the photoconductor unit 1 and developer unit 5, as a coupled assembly, (see FIG. 6) from the printer device, without the developer unit separating from the photoconductor unit.

Turning now to FIGS. 7, 8, 8A and 9, blocking mechanism 80 is included within photoconductor handle 23 comprising an elongated torsion rod 82 having journal ends 84a and 84b at opposites ends thereof. Integral with rod 82 and positioned inward from journals 84a and 84b are radially extending blocking arms 86a and 86b.

Journal ends 84a and 84b are rotatably received within a pair of laterally opposed, over center, "C" shaped receptacles 87, integrally molded into the structure of handle 23 as illustrated in FIG. 8A, or any other suitable receptacle mounting within which rod 82 may freely rotate. Affixed to torsion rod 82 is an offset toggle button 85 for manually rotating torsion rod 82. Torsion spring 89 is attached to at least one of the blocking arms 86 such that the blocking mechanism 80 is biased to the default blocking position as illustrated in FIG. 3. Upon depressing button 85, torsion rod 82 will rotate counterclockwise, as indicated by arrow A in FIG. 9, thereby rotating blocking arms 86 downward as illustrated in FIG. 10.

When blocking arms 86 are in their default, blocking position, as illustrated in FIG. 3, there is a small clearance, or gap, provided between blocking arms 86 and the bottom edge 93 of developer unit 5 such that in an attempt to remove developer unit 5 from photoconductor unit 1, bottom edge 93, of developer unit 5, will physically contact blocking arms 86 thereby preventing separation of developer unit 5 from photoconductor unit 1.

The physical contact between bottom edge 93 and blocking arms 86 is assured by the movement of guide studs 17, 19, 35 and 36 within their respective guide channels 9, 15, 31, and 30. In order to remove developer unit 5 from photoconductor unit 1, developer unit 5 must, by action of the guide channels, first translate horizontally before it can move upward and away from the photoconductor unit as illustrated in FIG. 11. Thus when blocking arms 86 are in their default blocking position, FIG. 3, developer unit 5 may not be separated from photoconductor unit 1.

However, when blocking arms 86 are rotated downward, by the operator depressing toggle button 85, blocking arms 86 are removed from the path of bottom edge 93, as illustrated in FIG. 10 thereby permitting passage of bottom edge 93 and removal of developer unit 5 from photoconductor unit 1 as illustrated in FIG. 11. Accordingly handle 21 is used to remove both units 1 and 5 together and by rotating blocking arm 86 downward, to remove unit 5 alone. Handle 23 on unit 1 is used only rarely, when unit 1 is replaced or discarded.

Since developer unit 5 contains the toner used for imaging, the developer unit will be removed and replaced with a replacement developer unit more frequently than photoconductor unit 1. Photoconductor unit 1 will only be removed and replaced when the photoconductor unit becomes deteriorated or when the photoconductor unit's waste toner sump is judged to be full.

Referring to FIG. 4, units 1 and 5, are shown from the left side and separated. Photoconductor unit 1 includes a guide channels 30 and 31 ending in a flat section 32 and 33 and having a rear wall 34 and 37. Developer unit 5 includes a guide studs 36 and 35. The side wall of photoconductor unit 1 includes an opening 38 to provide external access to driven coupling 40 when developer unit 5 is installed within photoconductor unit 1 (See FIG. 5).



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FIG. 5 illustrates units 1 and 5, as viewed from the left side, assembled in accordance with the present invention. Guide stud 36 is received in channel 30 but does not reach wall 34. Similarly guide stud 35 is received in channel 31 but does not reach wall 37. When assembled, as illustrated in FIGS. 2 and 5, channels 30, 31, 15, and 9 act to direct studs 36, 19, 17, and 35 respectively, thereby bringing developer roller 7 into aligned contact with photoconductor drum 3 (See FIG. 3). When units 1 and 5 are assembled as illustrated, in FIGS. 2 and 5, driven coupler 40 is aligned with opening 38 for access by a printer driving coupler (not shown).

The action of the drive coupling and the gears shown in FIGS. 3 and 4, will not be described in detail as they are essentially standard for imaging apparatus and drive known elements, not shown, including a toner, an adder roller and a toner mixing paddle, as well as the photoconductor drum 3 and developer roller 7. Similarly, with reference to FIG. 3, spring 46 biasing charge roller 48 against photoconductor 3 is standard and will not be further discussed.

Guide studs 17, 19, 35 and 36 preferably include external caps of polyacetal, a hard plastic, mounted on shafts integral with the body of developer unit 5. The body of developer unit 5 is preferably made of polystyrene. Polyacetal caps have a circumferential groove which meshes with small, radial tongues (not shown) extending into the grooves of the caps to thereby form studs 17, 19, 35 and 36. The polyacetal caps are free to rotate, but they may simply slide without loss of important function with respect to this invention. Alternative materials and construction of studs 17, 19, 35 and 36 could be readily employed by one skilled in this technology.

Referring now to FIG. 12, the inside of printer cover 50 is illustrated, which may be made of any suitable, strong plastic. Mounted on opposite sides of cover 50 are pivot arms 52a and 52b, having near their ends pivot studs 54a and 54b. Pivot studs 54a and 54b enter frame F (See FIG. 12) of the printer structure (not shown) to define fixed pivot points for cover 50 relative to the frame F.

Mounted on the inside of cover 50 is one-piece housing 56, attached to cover 50 by four screws, 58a, 58b, 58c and 58d. Housing 56 includes latching members 60a and 60b on opposite sides of cover 50. Primarily significant to this invention, housing 50 confines a leaf spring 62, having opposed bent ends 62a and 62b which extend past housing 56 at openings 56a and 56b on opposite sides of cover 50.

Housing 56 includes integral, upward extending arms 56a, 56b, 56c, and 56d (see FIG. 12) which contact cover extensions 50a, 50b, 50c, and 50d. Screws 58a, 58b, 58c, and 58d are located in lateral, oval slots in housing 56. Integral with housing 56, on the left, is a flat, pressing surface or "button" 64. When cover 50 is closed, latching members 60a and 60b are pushed leftward by arms 56a, 56b, 56c, and 56d acting on extensions 50a, 50b, 50c, and 50d. A user pushing on button 64 overcomes this force and frees latches 60a and 60b to allow cover 50 to be opened.

FIG. 13 presents a similar view as that in FIG. 12 with housing 56 and its integral assemblies deleted so as to better illustrate spring 62 and its mounting. In the embodiment illustrated in FIG. 13, spring 62, a single leaf spring, is attached to cover 50 by two screws 70a, 70b located at the center of spring 62. Spring 62 is held against undue movement away from cover 50 by spaced ledge members 72a, 72b on cover 50. Spring 62 is confined from undue lateral movement by extensions 72aa and 72bb holding ledge members 72a and 72b and by upper and lower spaced ledges 74a, 74aa and 74b and 74bb. Mounting posts 76a-76d receive screws 58a, 58b, 58c, and 58d (See FIG. 13).

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Referring now to FIG. 14, printer cover 50 is illustrated in an open position with the cartridge assembly, comprising developer unit 5 and photoconductor unit 1, in its installed position within the printer. The printer structure is illustrated as frame elements F. The installed photoconductor unit 1 and developer unit 5 are held in place and prevented from moving away from cover 50 by action of frame F.

In FIG. 15 cartridge photoconductor unit 1 has been removed to better illustrate developer unit 5 and its interaction with cover 50 and is illustrated in its installed position. As illustrated in FIG. 15 developer unit 5 has a substantially vertical front wall 70. Upon closing cover 50, the ends 62a and 62b encounter front wall 70 of cartridge developer unit 5 thereby applying pressure against wall 70 urging developer unit 5 against photoconductor unit 1. Thus the installed units 1 and 5 are held against movement away from door 50 by frame members F of the printer. Latch members 60a and 60b (See FIG. 12) flex past ledges (not shown) in the printer frame F and latch over the ledges thereby securing cover 50 to the printer frame.

#### VARIATIONS AND ALTERNATIVES

Although a specific embodiment of the invention has been disclosed, there is no intent to thereby limit the invention to the specific embodiment illustrated herein. On the contrary, the intention herein is to cover all modifications, alternatives, embodiments, usage and/or equivalents of the subject invention as may fall within the spirit and scope of the invention as disclosed. Accordingly, the scope of the present invention is to be considered in terms of the following claims and understood not to be limited to the details of the structures and methods shown and described in the specification and drawings.

What is claimed is:

1. A replaceable two piece image forming cartridge for use in an image forming apparatus said cartridge comprising:

a photoconductor unit having a developer unit removably coupled thereto; and

blocking means affixed to said photoconductor unit, said blocking means having a blocking position and a non-blocking position whereby said photoconductor unit and developer unit may be inserted into and removed from said image forming apparatus as an assembly when said blocking means is in the blocking position, and whereby said developer unit may be separately removed from said photoconductor unit when said blocking means is in the non-blocking position,

said photoconductor unit having a handle for removing said photoconductor unit and said developer unit from said image forming apparatus as an assembly and wherein said handle includes said blocking means.

2. The two piece image forming cartridge as claimed in claim 1 wherein said developer unit includes a handle suitable for removing said photoconductor unit and said developer unit from said image forming apparatus as an assembly.

3. The two piece image forming cartridge as claimed in claim 1 wherein:

said photoconductor unit includes at least one guide channel for determining the path that the developer unit travels when said developer unit is coupled with, or removed from, said photoconductor unit and

said blocking means includes at least one movable blocking arm having a blocking position and a non-blocking

position, said movable blocking arm extending toward said developer unit such that the path traveled by said developer unit upon removal from said photoconductor unit is blocked by said blocking arm, whereby said developer unit is restricted from removal by said blocking arm.

4. The two piece image forming cartridge as claimed in claim 3 wherein said blocking means comprises:

- a) a torsion rod rotatably attached to said handle,
- b) the at least one movable blocking arm affixed to said torsion rod and extending radially therefrom towards said developer unit,
- c) spring means for biasing said torsion rod and said blocking arm toward its blocking position, and
- d) a button affixed to said torsion rod whereby application of a force upon said button causes said torsion rod to rotate, thereby moving said blocking arm from said blocking position toward said non-blocking position.

5. A removable, two piece, image processing cartridge for use with an image forming machine wherein,

- a) said processing cartridge comprises a photoconductor unit upon which a detachable developer unit is mounted,
- b) a plurality of guide channels embodied within said photoconductor unit and a plurality of associated guide studs affixed to said developer unit such that said guide studs engage said guide channels thereby guiding said developer unit, into its desired operating position, along a predetermined path of travel when coupling said developer unit to said photoconductor unit and detachment therefrom,
- c) a handle attached to said photoconductor unit for removing said photoconductor unit and said developer unit from said image forming machine as a coupled assembly, said handle including at least one, movable blocking arm extending from said handle toward said developer unit, said blocking arm having a closed blocking position and an open non-blocking position, such that when said blocking arm is in its closed position, said blocking arm extends into the path of said developer unit as said developer unit is being removed from said photoconductor unit thereby preventing removal of said developer unit from said photoconductor unit and when said blocking arm is in its open non-blocking position, said blocking arm is removed from the path of said developer unit thereby permitting removal of said developer unit free from said photoconductor unit.

6. The two piece image processing cartridge as claimed in claim 5 wherein said blocking arm includes:

- a) a torsion rod attached to one end of said blocking arm, said torsion rod rotatably attached to said handle,
- b) spring means biasing said torsion rod and said blocking arm to its closed blocking position,
- c) an eccentric toggle button affixed to said torsion rod whereby application of a force upon said toggle button causes said torsion rod to rotate, about its axis, thereby moving said blocking arm from said closed blocking position to said open non-blocking position.

7. In a two piece toner cartridge assembly comprising a photoconductor unit and a separable developer unit, a method of coupling the two assemblies together in a non-separable relationship comprising the steps of:

- a) providing at least two guide channels within said photoconductor unit for receiving therein associated

guide members affixed to said developer unit whereby the path of said developer unit, when assembling said developer unit to said photoconductor unit or separation of said developer unit from said photoconductor unit, is determined by the movement of said guide members within said guide channels,

- b) providing a movable blocking member upon said photoconductor unit, said blocking member having a blocking position and a non-blocking position whereby said blocking member, when in its blocking position, extends into said path of said developer unit thereby preventing said developer unit from being separated from said photoconductor unit and when said blocking member is in its non-blocking position said blocking member is removed from said developer unit's path thereby permitting separation of said developer unit from said photoconductor unit.

8. A replaceable two piece image forming cartridge for use in an image forming apparatus, said cartridge comprising: a) a first unit having a second unit removably coupled thereto,

- b) blocking means affixed to said first unit, said blocking means having a blocking position and a non-blocking position, whereby the image forming cartridge comprising said first and second units coupled together may be inserted into and removed from said image forming apparatus, when said blocking means is in its blocking position, and whereby said second unit may be removed from said first unit when said blocking means is in the non-blocking position, whereby said first unit without the second unit coupled thereto may be removed from said image forming apparatus.

9. The replaceable two piece image forming cartridge of claim 8 wherein the first unit includes a handle for removing the image forming cartridge from the imaging forming apparatus, and wherein the handle includes the blocking means.

10. A toner cartridge assembly for use in an image forming apparatus, the toner cartridge assembly comprising:

- a developer unit;
- a photoconductor unit configured to receive and retain the developer unit, the photoconductor unit including:
  - a blocking mechanism for inhibiting removal of the developer unit from the photoconductor unit when the blocking mechanism is in a blocking position, and for not inhibiting removal of the developer unit from the photoconductor unit when the blocking mechanism is in a non-blocking position;
- a first handle for removing the toner cartridge assembly from the image forming apparatus; and
- a depressible button on the first handle and coupled to the blocking mechanism, the button for causing movement of the blocking mechanism from the blocking position to the non-blocking position when the button is depressed, such that the developer unit may be removed from the photoconductor unit when the button is depressed.

11. The toner cartridge assembly of claim 10 wherein the developer unit includes a second handle for removing the developer unit from the photoconductor unit when the button on the first handle is depressed.

12. The toner cartridge assembly of claim 10 wherein the developer unit includes a second handle for removing the toner cartridge assembly from the image forming apparatus when the button on the first handle is not depressed.

\* \* \* \* \*

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# THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office

December 31, 2009

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: 6,879,792

ISSUE DATE: *April 12, 2005*

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



P. SWAIN  
Certifying Officer

A4411



US006879792B2

(12) **United States Patent**  
**Carter et al.**

(10) **Patent No.:** **US 6,879,792 B2**  
(45) **Date of Patent:** **Apr. 12, 2005**

(54) **TWO PART CARTRIDGES WITH FORCE BIASING BY PRINTER**

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(73) **Assignee:** **Lexmark International, Inc.**, Lexington, KY (US)

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) **Appl. No.:** **10/736,355**

(22) **Filed:** **Dec. 15, 2003**

(65) **Prior Publication Data**

US 2004/0126133 A1 Jul. 1, 2004

#### Related U.S. Application Data

(63) Continuation of application No. 10/195,270, filed on Jul. 15, 2002, now Pat. No. 6,678,489.

(51) **Int. Cl.**<sup>7</sup> ..... **G03G 21/18**

(52) **U.S. Cl.** ..... **399/113; 399/114**

(58) **Field of Search** ..... 399/26, 107, 111-114, 399/116, 117, 155

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*Primary Examiner*—Arthur T. Grimley

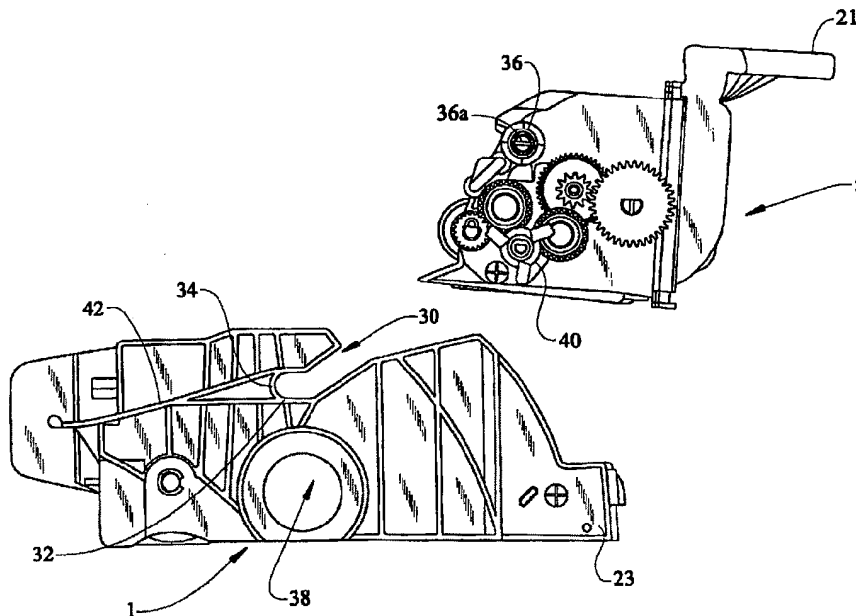
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(74) *Attorney, Agent, or Firm*—Joseph Arrombide; Arthur I. Navarro

#### (57) ABSTRACT

A two part cartridge having a photoconductor part (1) and a toner part (5) having no force biasing element on either part. The two parts fit together so that a developer roller (7) in the toner part contacts a photoconductor drum (3) in the other part. When the two parts are installed in a printer the cover (50), when closed, brings a spring (62) into contact with one side of the toner part while the frame (F) of the printer blocks movement away from the cover. An advantage of the two part cartridge is that the toner part can be replaced without replacing the photoconductor part. Members on the cartridge for force biasing are avoided and the need for training or skill to latch the parts together is avoided.

**11 Claims, 9 Drawing Sheets**



## U.S. Patent

**Apr. 12, 2005**

Sheet 1 of 9

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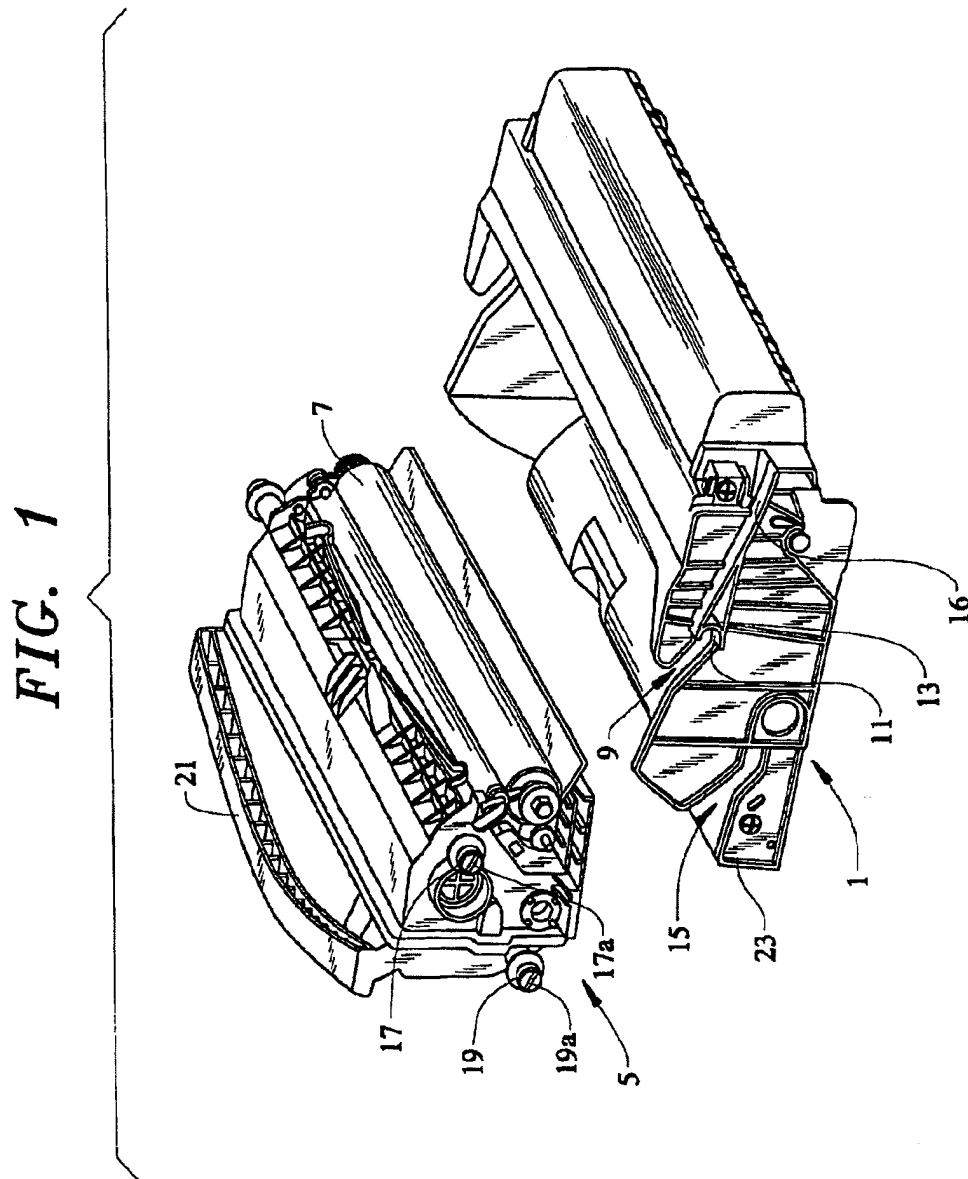
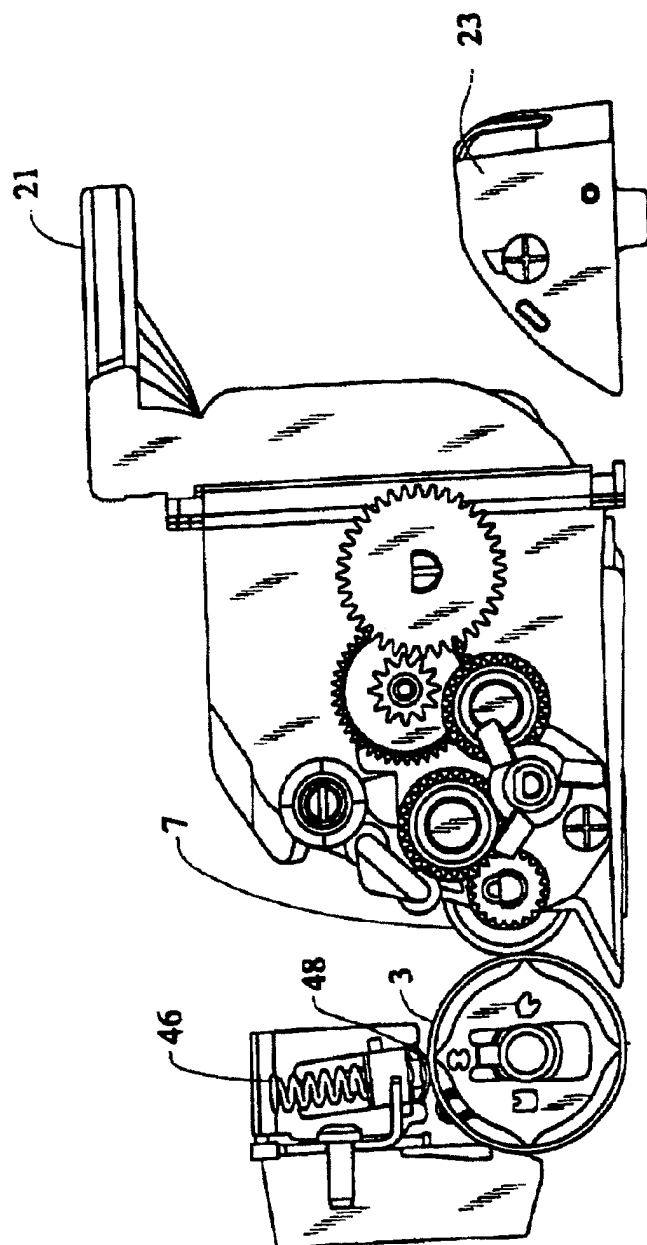


FIG. 2



**FIG. 3**

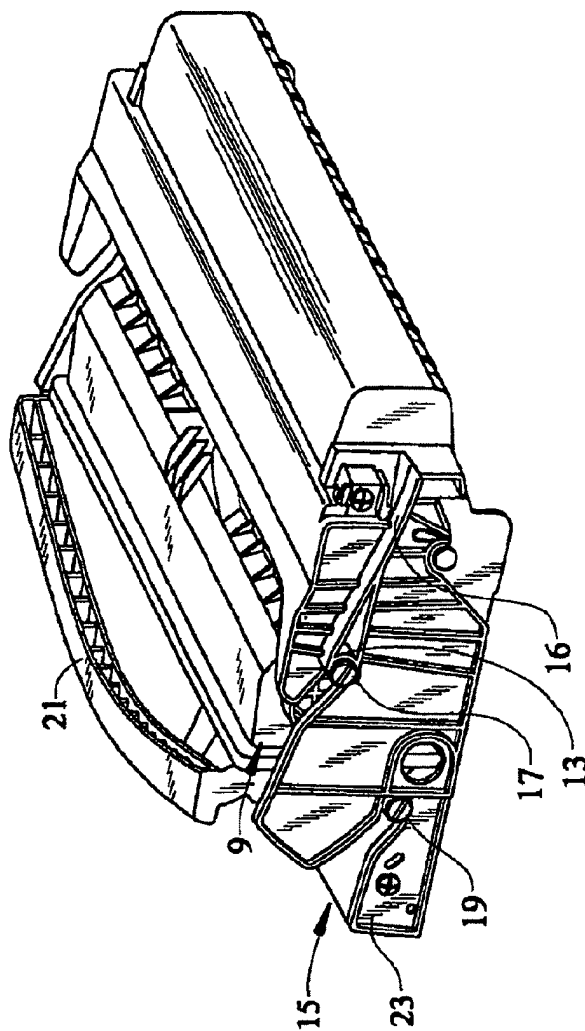


FIG. 4

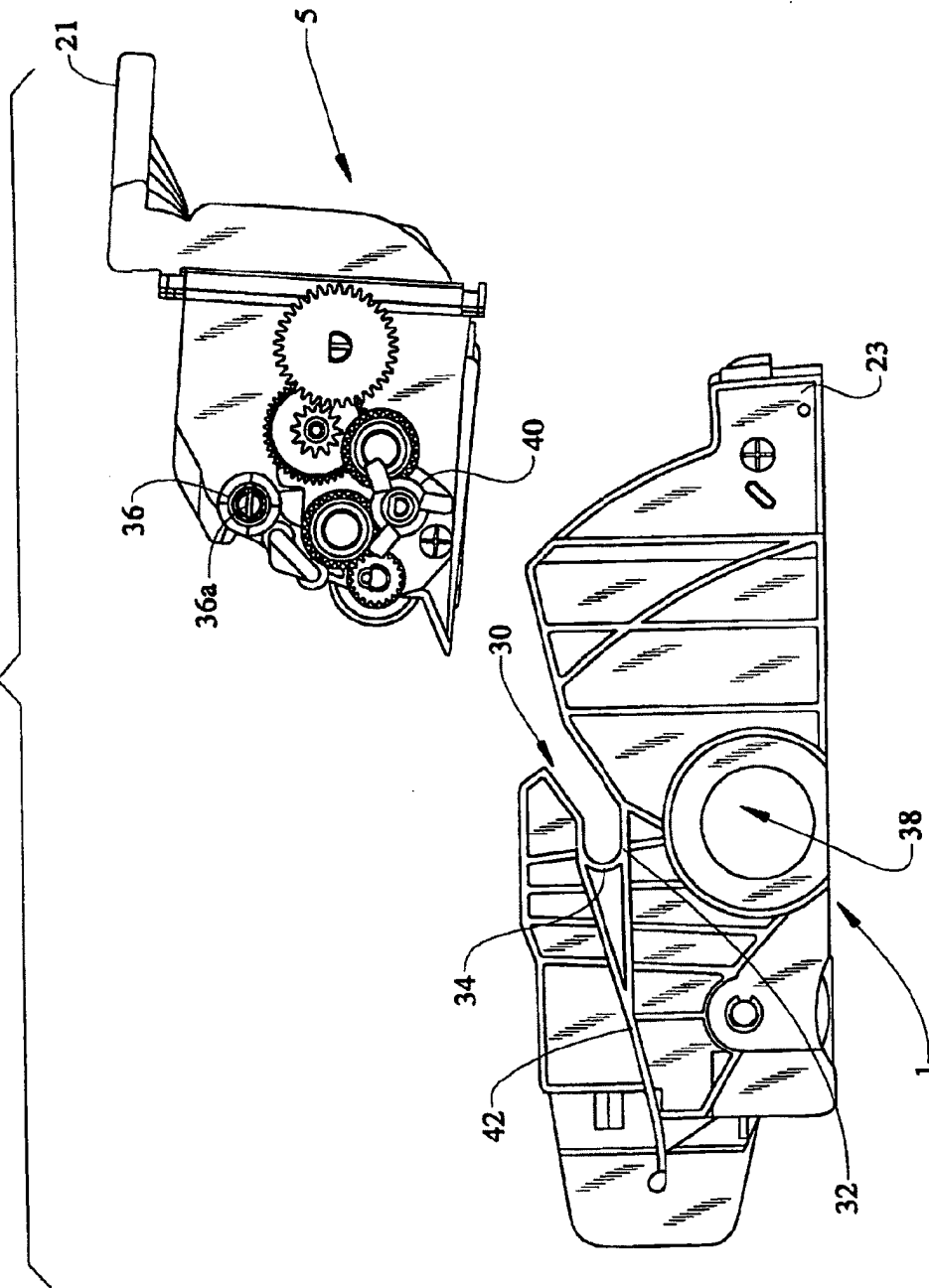


FIG. 5

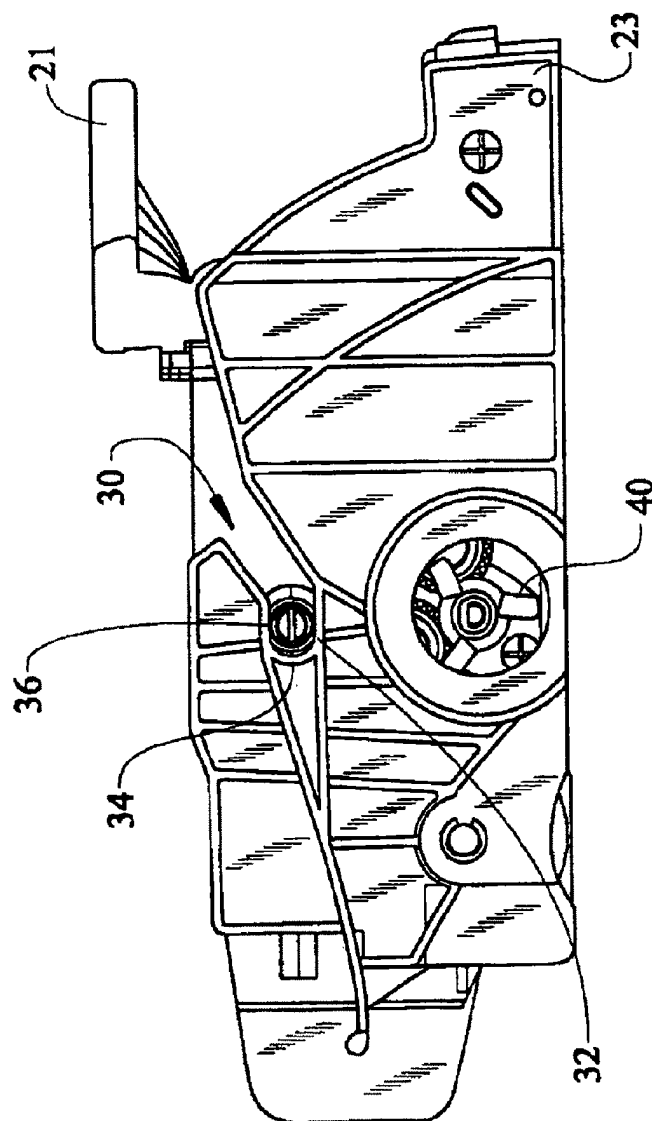




FIG. 6

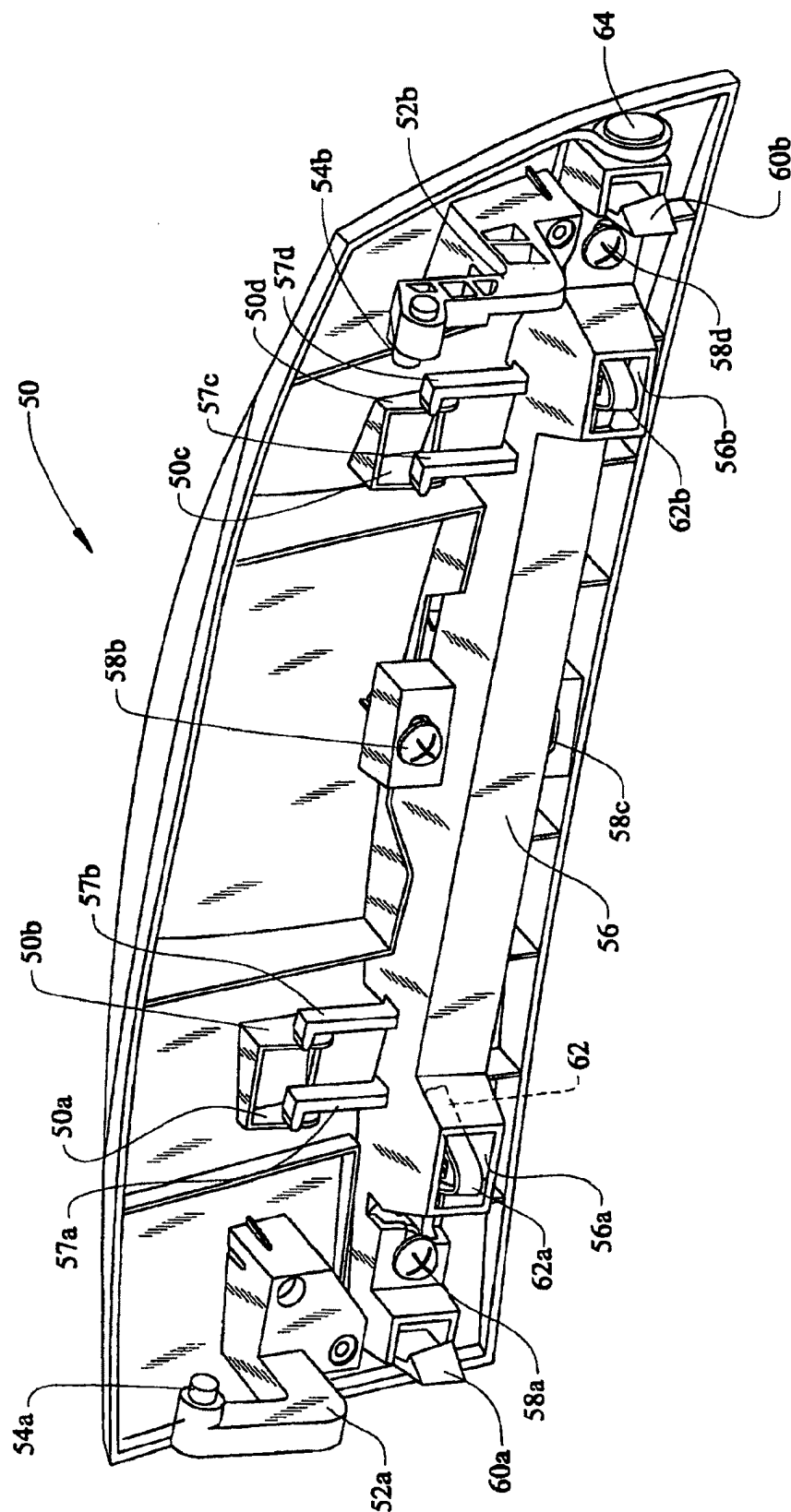
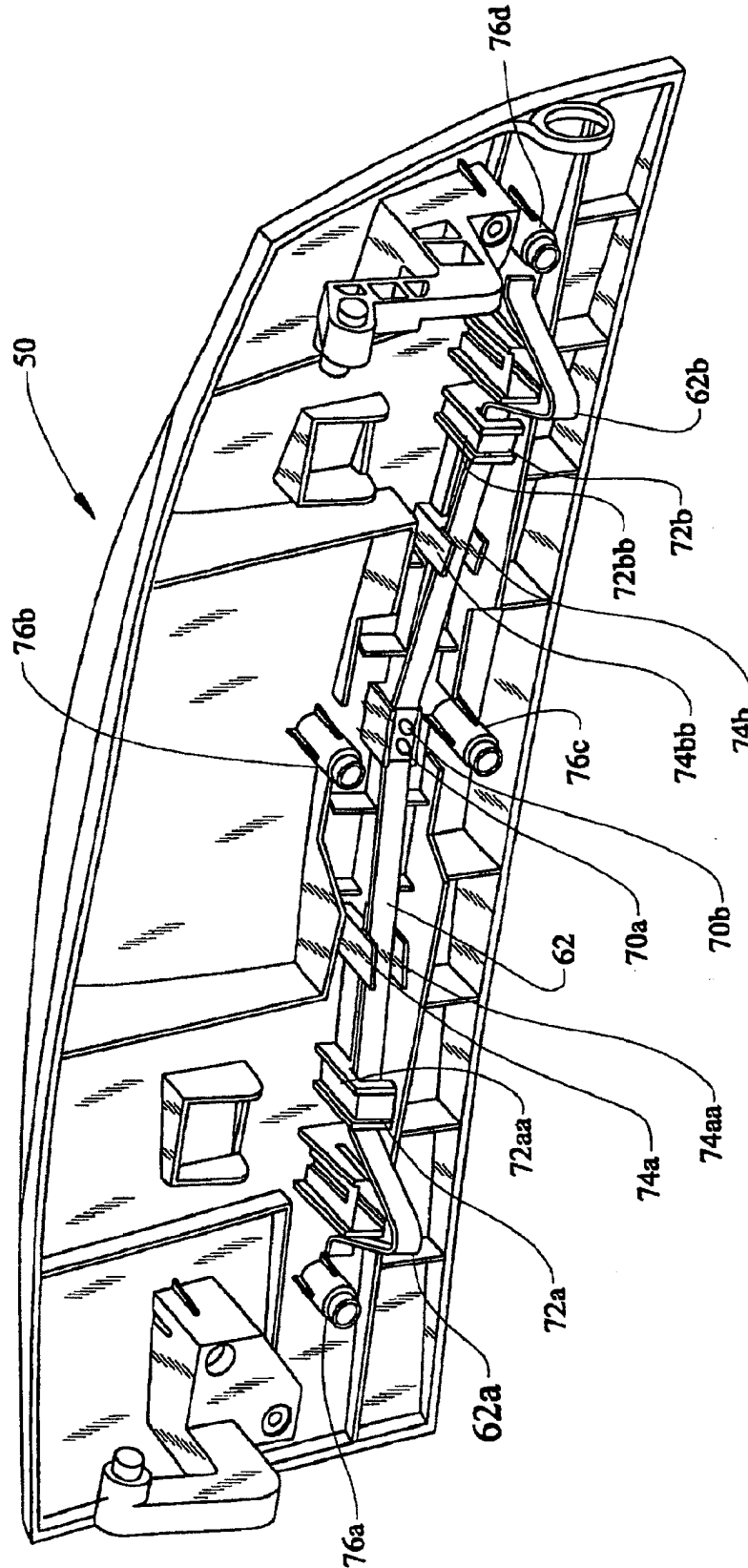


FIG. 7



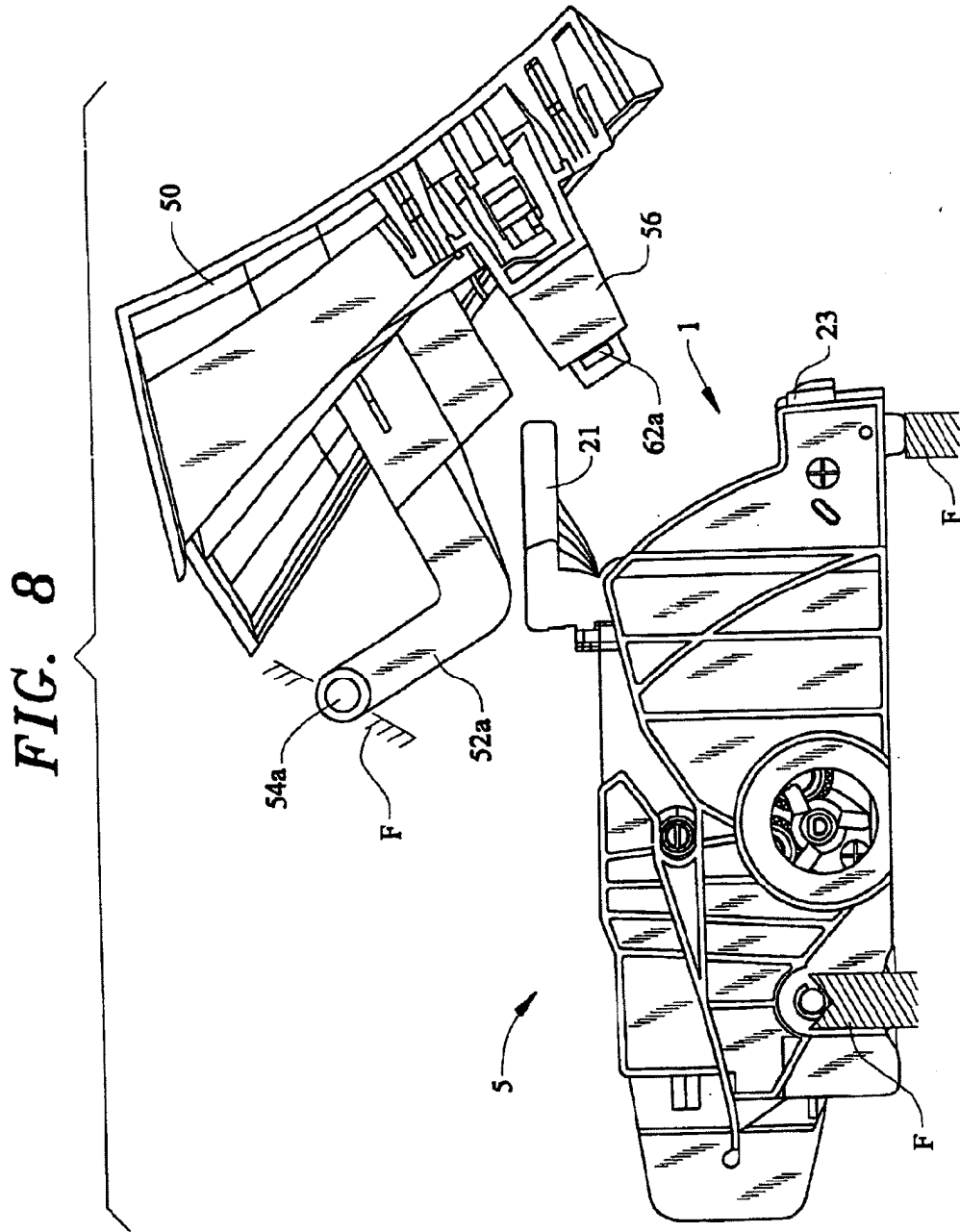
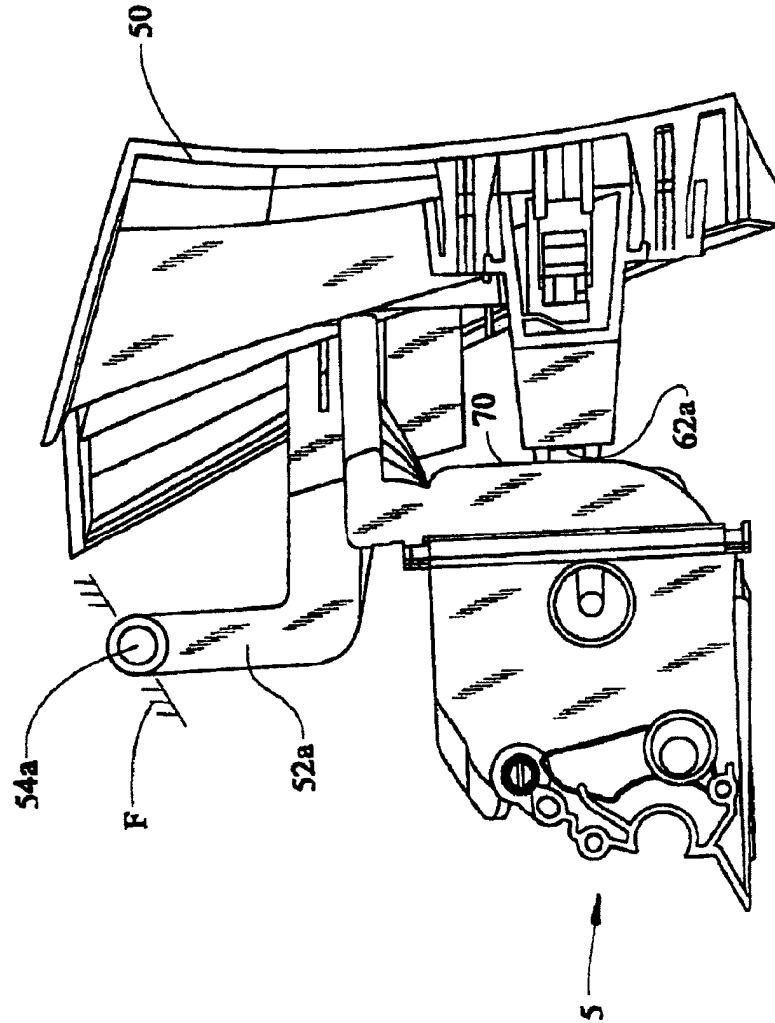


FIG. 9



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## TWO PART CARTRIDGES WITH FORCE BIASING BY PRINTER

### RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 10/195,270, filed Jul. 15, 2002 now U.S. Pat. No. 6,678,489, and titled Two Part Cartridges with Force Biasing by Printer.

### TECHNICAL FIELD

This invention relates to electrophotographic imaging and, more particularly, relates to separate replaceable cartridges for toner and photoconductor, which are pressed together for good operation when installed in the imaging device.

### BACKGROUND OF THE INVENTION

Electrophotographic toner cartridges are often joined in two sections pivoted to one another so that a developer roller can be pressed against a photoconductor drum with controlled pressure. The controlled pressure is provided by permanently installed springs stretching between the two sections. The two sections are not normally separated, so such cartridges can be said to be one part cartridges.

Such one part cartridges have the advantage of having the spring force installed at the factory manufacturing the cartridge and having a relatively short duration during which the springs need provide the correct pressure, since the entire cartridge is refurbished (or discarded) after use of the original cartridge. Such one-piece cartridges have the disadvantage that the springs must be included on each cartridge. Also, for such one piece cartridges, replacement of the toner with a new section having the toner is not practical since the sections are not readily separated.

Two part cartridges are known in which a part having the toner is readily separated from a part having the photoconductor drum, since they are not pivoted to one another. To install such two part cartridges for imaging, they are manually brought together by the operator, and then the operator activates a latching mechanism, such as a resilient latch or a lever of some kind, to force the two parts together with the appropriate pressure for imaging.

A disadvantage of such known two part cartridges is that the forcing mechanism must be on one or both of the two parts and therefore adds to supplies costs, as both of the two parts are typically replaceable as they are worn (in the case of the photoconductor and other physical parts) or expended (in the case of the toner). Another disadvantage is that operator involvement requires training or some skill, and requires an overall design which permits the operator to reach the latching mechanism and activate it or deactivate it. A further disadvantage is that the force biasing elements require some space in the body of the imaging device.

### DISCLOSURE OF THE INVENTION

This invention provides for two part cartridges which have no mechanism to latch the cartridges together. Biasing force during use is provided from the cover of the imaging device when closed. The two parts need only have conforming external configurations so that they fit together, and require no space in the middle of the printer for a force biasing element. No operator involvement in forcing the two parts together is required except for inserting the cartridges in the imaging device and closing the cover of the imaging device. Although the biasing by the cover may be by a spring

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or springs more costly than springs or other forcing mechanism which might be on the parts, over the life of the imaging device the overall costs typically will be less.

### BRIEF DESCRIPTION OF THE DRAWINGS

The details of this invention will be described in connection with the accompanying drawings, in which

FIG. 1 is a perspective view from the right of the two parts of the cartridge separated;

FIG. 2 is a side view from the left with covers removed showing selected parts of the two parts of the cartridge in contact when being forced together by the cover of the printer;

FIG. 3 is a side view from the right of the two parts of the cartridge forced together;

FIG. 4 is a side view from the left of the two parts of the cartridge separated;

FIG. 5 is a side view from the left of the two parts of the cartridge forced together;

FIG. 6 is a perspective view from the left showing the inside of the cover of the printer;

FIG. 7 is a perspective view of the cover like the view of FIG. 6 with a housing deleted to fully show the spring mounting;

FIG. 8 is a side view from the left sectioned in the middle of the cover showing the cover open and the cartridge parts installed in the printer; and

FIG. 9 is a side view as in FIG. 8 showing part 5 with the cover pivoted to its final position in which it is applying a force by contacting on the toner part of the cartridge.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a replaceable cartridge part 1 containing a photoconductive drum 3 (shown in FIG. 2) is shown separated from a replaceable cartridge part 5 containing a developer roller 7 and toner (not shown). The right side of part 1 has an upper guide channel 9 ending in a flat section 11 having a rear wall 13. The right side of part 1 also has a lower guide channel 15. Planar member 16 is a guide for installation in a printer.

The right side of part 5 has an upper guide stud 17 and a lower guide stud 19. FIG. 3 shows the two parts 1 and 5 forced together in accordance with this invention. Guide stud 17 fits in channel 9 but does not reach wall 13. Similarly, guide stud 19 fits in channel 15. Channels 9 and 15 direct the guide studs 17 and 19 respectively to bring developer roller 7 in contact with photoconductor drum 3 (FIG. 2).

Part 5 has an upper handle 21, which can be readily grasped by an operator to pull part 5 away from part 1. Part 1 has a lower handle 23 which extends past part 5 when the two are combined (FIG. 2). Handle 21 and handle 23 can be grasped and pulled by an operator to pull out part 1 and part 5.

Since part 5 contains toner used for imaging, part 5 will be extracted and replaced with a replacement part 5 having toner more frequently than part 1 will be replaced. Part 1 will be extracted and replaced with a replacement part 1 when the photoconductor becomes deteriorated or when excess toner fills the compartment in part 1 for toner cleaned from the photoconductor 3 (such cleaning is standard).

Referring to FIG. 4, the two parts 1 and 5 are shown from the left side separated. Part 1 has a guide channel 30 ending



in a flat section 32 having a rear wall 34. Part 5 has a guide stud 36. The cover of part 1 has an opening 38 to provide external access to driven coupling 40 when part 5 is pressed against part 1 (FIG. 5). Planar member 42 is a guide for installation in a printer, as is standard.

The action of the drive coupling and the gears shown will not be described in detail as they are essentially standard for imaging by driving known parts, not shown, including a toner adder roller and a toner mixing paddle, as well photoconductor drum 3 and the developer roller 7. Similarly, with reference to FIG. 2, spring 46 biasing a change roller 48 against photoconductor 3 is standard and will not be further discussed.

FIG. 5 shows parts 1 and 5 from the left forced together in accordance with this invention. Guide stud 36 fits in channel 30 but does not reach wall 34. Channel 30 directs stud 36 to bring developer roller 7 in contact with photoconductor drum 3 (FIG. 2). Driven coupler 40 is located in opening 38 (FIG. 4) for access by a printer drive coupler (not shown).

Guide studs 17, 19 and 36 are external caps of DELRIN 500 polyacetal, a hard plastic, mounted on shafts integral with the body of part 5. The body of part 5 is made of polystyrene. Openings 17a, 19a (FIG. 1) and 36a (FIG. 4) permit flexing of the shafts. The DELRIN polyacetal caps have a circumferential groove which meshes with small, radial tongues (not shown) extending into the grooves of the caps to thereby form studs 17, 19 and 38. The caps are free to rotate, but they may simply slide without loss of important function with respect to this invention. Alternative materials and construction of studs 17, 19 and 36 could be readily employed.

Referring to FIG. 6, the inside of printer cover 50 is shown, which may be made of a standard, strong plastic. Mounted on opposite sides of cover 50 are pivot arms 52a and 52b, having near their ends pivot studs 54a and 54b. Pivot studs 54a and 54b enter frame F (FIG. 8) of the printer (only frame of printer illustrated in this description) to define fixed pivot points of cover 50 relative to the frame F.

Mounted on the inside of cover 50 is one-piece housing 56, mounted to cover 50 by four screws, 58a-58d. Housing 56 has latching members 60a and 60b on opposite sides of cover 50. Primarily significant to this invention, housing 50 confines a leaf spring 62, having opposed bent ends 62a and 62b which extend past housing 56 at openings 56a and 56b on opposite sides of cover 50.

Housing 56 has integral, upward extending arms 57a-57d, which contact cover extensions 50a-50d. Screws 58a-58d are located in lateral, oval slots in housing 56. Integral with housing 56 on the left is a flat, pressing surface or "button" 64. When cover 50 is closed, latching members 60a and 60b are pushed leftward by arms 57a-57d acting on extensions 50a-50d. An operator pushing on button 64 overcomes this force and frees latches 60a and 60b to allow cover 50 to open.

FIG. 7 is the same view as FIG. 6 with housing 56 and its integral parts deleted so as to better show spring 62 and its mounting. In this embodiment, spring 62 is a single leaf spring held against cover 50 by two screws 70a, 70b located at the center of spring 62. Spring 62 is held against undue movement away from cover 50 by spaced ledge members 72a, 72b on cover 50. Spring 62 is confined from undue movement laterally by the extensions 72aa and 72bb holding ledge members 72a and 72b and by upper and lower spaced ledges 74a, 74aa and 74b and 74bb. Mounting posts 76a-76d receive screws 58a-58d (FIG. 6).

FIG. 8 shows cover 50 open and the full cartridge of parts 1 and 5 in its installed position on the printer, illustrated as frame elements F. The installed parts are held against further movement away from cover 50 by being blocked by frame F.

FIG. 9 omits cartridge part 1 to better illustrate cartridge part 5. Part 5 is also in the installed position as shown in FIG. 8. In this position part 1 has a substantially vertical front wall 70. Upon closing of cover 50, the ends 62a and 62b encounter front wall 70 of cartridge part 5 and press it against part 1. As discussed with respect to FIG. 8, the installed cartridge parts 1 and 5 are held against movement away from door 50 by frame members of the printer. Latch members 60a and 60b flex past ledges (not shown) in the frame F and then latch over the ledges,

#### VARIATIONS AND ALTERNATIVES

Although spaced spring contacts as in the foregoing embodiment tend to minimize variations between printers from differences within accepted tolerance, clearly a single leaf spring mounted in the center is an alternative. Of course, two spaced coil springs is an alternative. Other members can provide resilience, such a urethane rubber pads. Instead of spaced contacts, a wide, resilient pad could provide the force biasing. In sum, this invention is not deemed limited by the details of the biasing member operating from the cover. The cover could provide a linkage to move a separated biasing member with movement of the cover, although this normally would be more expensive than simply mounting the biasing member on the cover.

A modification of the foregoing under consideration is to replace spring 62 by two, separate leaf springs, each originating near the middle of cover 50 and terminating as shown in the foregoing.

Although the cover in the foregoing embodiment opens from the bottom, a clear alternative would be to hinge the cover on the bottom so that it opens from the top.

Other variations and alternatives will be readily apparent or can be anticipated.

What is claimed is:

1. A two part imaging cartridge in which one part is in contact with the other part by at least two guide studs on one of said two parts entering at least two guide channels on the other of said two parts, one of said two parts containing a developer member and the other of said two parts containing a photoconductor, said guide channel being directed to bring said developer member in contact with said photoconductor and having an open end for said entry of said guide stud; said two parts having no force biasing member on either part for force biasing said photoconductor against said developer member, force biasing for imaging being dependent upon external force being applied to said two parts;
2. said part containing a developer member having at least one of said two guide studs.
2. The two part imaging cartridge of claim 1 wherein said two guide studs are on one side of one of said two parts.
3. The two part imaging cartridge of claim 2 wherein said two guide channels are one side of the other of said two parts opposite said two guide studs.
4. The two part imaging cartridge of claim 1 wherein said two guide studs comprise an upper guide stud and a lower guide stud on one side of one of said two parts.
5. The two part imaging cartridge of claim 4 wherein said two guide channels comprise an upper guide channel and a lower guide channel on one side of the other of said two parts opposite said two guide studs.



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6. The two part imaging cartridge of claim 1 further comprising a third guide stud on one of said two parts entering a third guide channel on the other of said two parts.

7. The two part imaging cartridge of claim 6 wherein two of said guide studs are one side of one of said two parts and enter guide channels on one side of the other of said two parts.

8. The two part imaging cartridge of claim 7 wherein a third of said guide studs are on a second side of one of said two parts and enters a guide channel on a second side of the other of said two parts.

9. The two part imaging cartridge of claim 1 further comprising a first handle on one of said two parts.

10. The two part imaging cartridge of claim 9 further comprising a second handle on the other of said two parts.

11. A two part imaging cartridge in which one part is in contact with the other part by at least two guide studs on one

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of said two parts entering at least two guide channels on the other of said two parts, one of said two parts containing a developer member and the other of said two parts containing a photoconductor, said guide channels being directed to bring said developer member in contact with said photoconductor and having an open end for said entry of said guide studs;

said two parts having no force biasing member on either part for force biasing said photoconductor against said developer member, force biasing for imaging being dependent upon external force being applied to said two parts;

said part containing a photoconductor having at least one of said two guide channels.

\* \* \* \* \*

U 7218663



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UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office

January 04, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
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U.S. PATENT: 7,139,510

ISSUE DATE: November 21, 2006

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office

T. LAWRENCE  
Certifying Officer





US007139510B2

(12) **United States Patent**  
**Carter et al.**

(10) **Patent No.:** **US 7,139,510 B2**  
(45) **Date of Patent:** **Nov. 21, 2006**

(54) **TWO PART CARTRIDGES WITH FORCE BIASING BY PRINTER**

(75) Inventors: **Philip Scot Carter**, Lexington, KY (US); **Julia L. Fain**, Lexington, KY (US); **Mark Duane Foster**, Lexington, KY (US)

(73) Assignee: **Lexmark International, Inc.**, Lexington, KY (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/057,550**

(22) Filed: **Feb. 14, 2005**

(65) **Prior Publication Data**

US 2005/0147430 A1 Jul. 7, 2005

**Related U.S. Application Data**

(63) Continuation of application No. 10/736,355, filed on Dec. 15, 2003, now Pat. No. 6,879,792, which is a continuation of application No. 10/195,270, filed on Jul. 15, 2002, now Pat. No. 6,678,489.

(51) **Int. Cl.**  
**G03G 21/18** (2006.01)

(52) **U.S. Cl.** ..... 399/113

(58) **Field of Classification Search** ..... 399/107, 399/111-114, 116, 117  
See application file for complete search history.

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*Primary Examiner*—David M. Gray

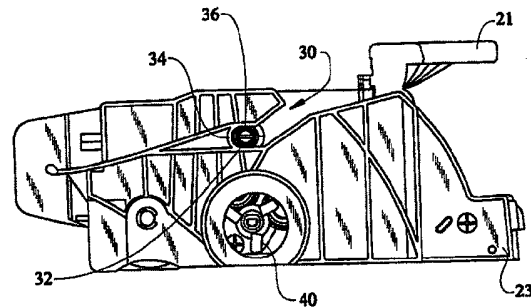
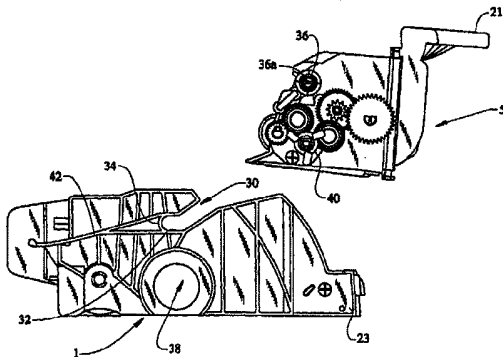
*Assistant Examiner*—Ryan Gleitz

(74) *Attorney, Agent, or Firm*—Navarro Law Offices, PC

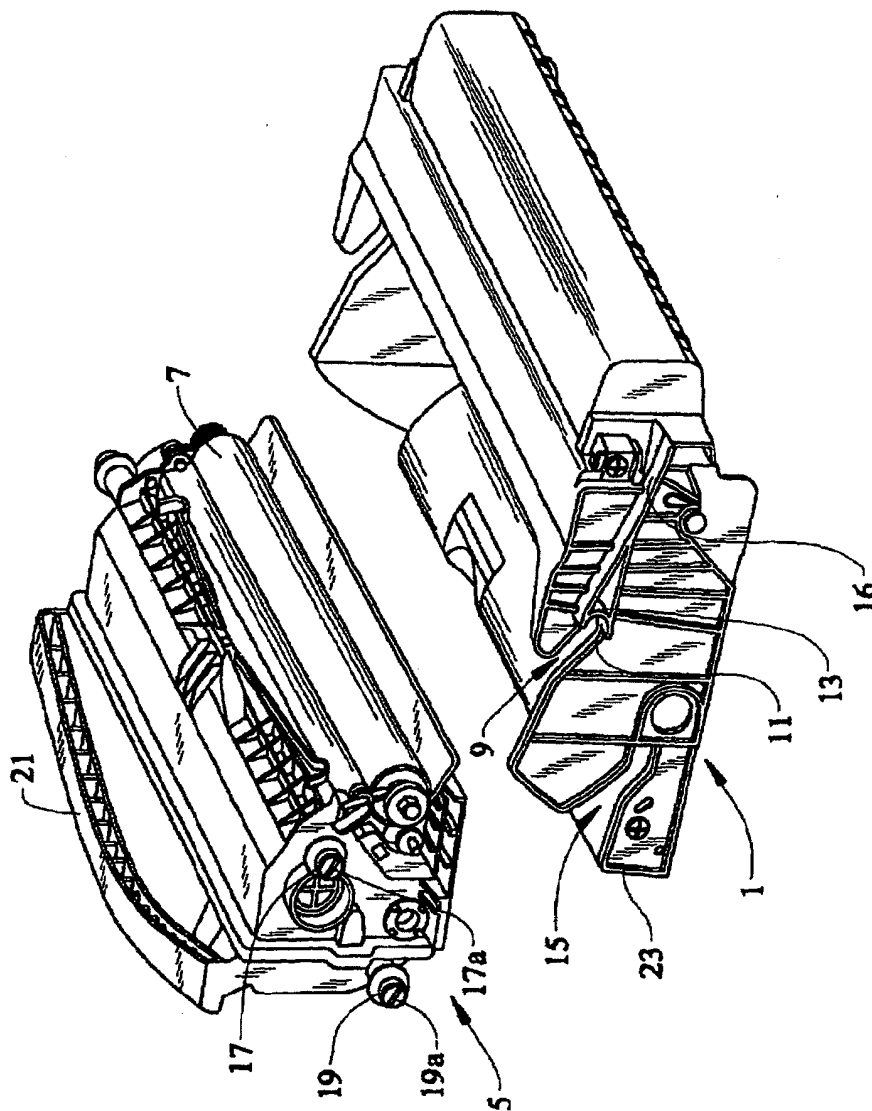
(57) **ABSTRACT**

A two part cartridge having a photoconductor part (1) and a toner part (5) having no force biasing element on either part. The two parts fit together so that a developer roller (7) in the toner part contacts a photoconductor drum (3) in the other part. When the two parts are installed in a printer the cover (50), when closed, brings a spring (62) into contact with one side of the toner part while the frame (F) of the printer blocks movement away from the cover. An advantage of the two part cartridge is that the toner part can be replaced without replacing the photoconductor part. Members on the cartridge for force biasing are avoided and the need for training or skill to latch the parts together is avoided.

**10 Claims, 9 Drawing Sheets**



**FIG. 1**



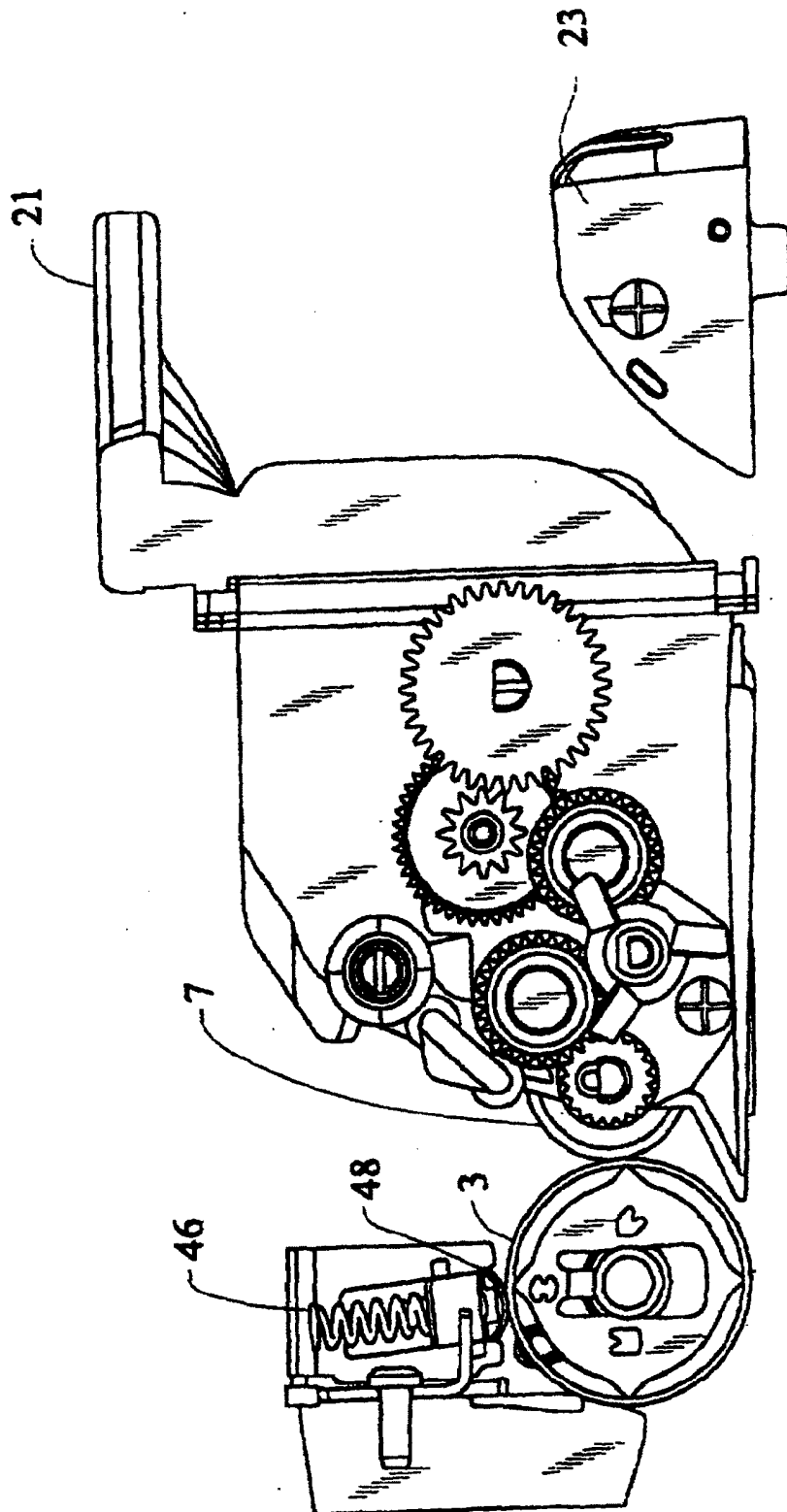
U.S. Patent

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FIG. 2



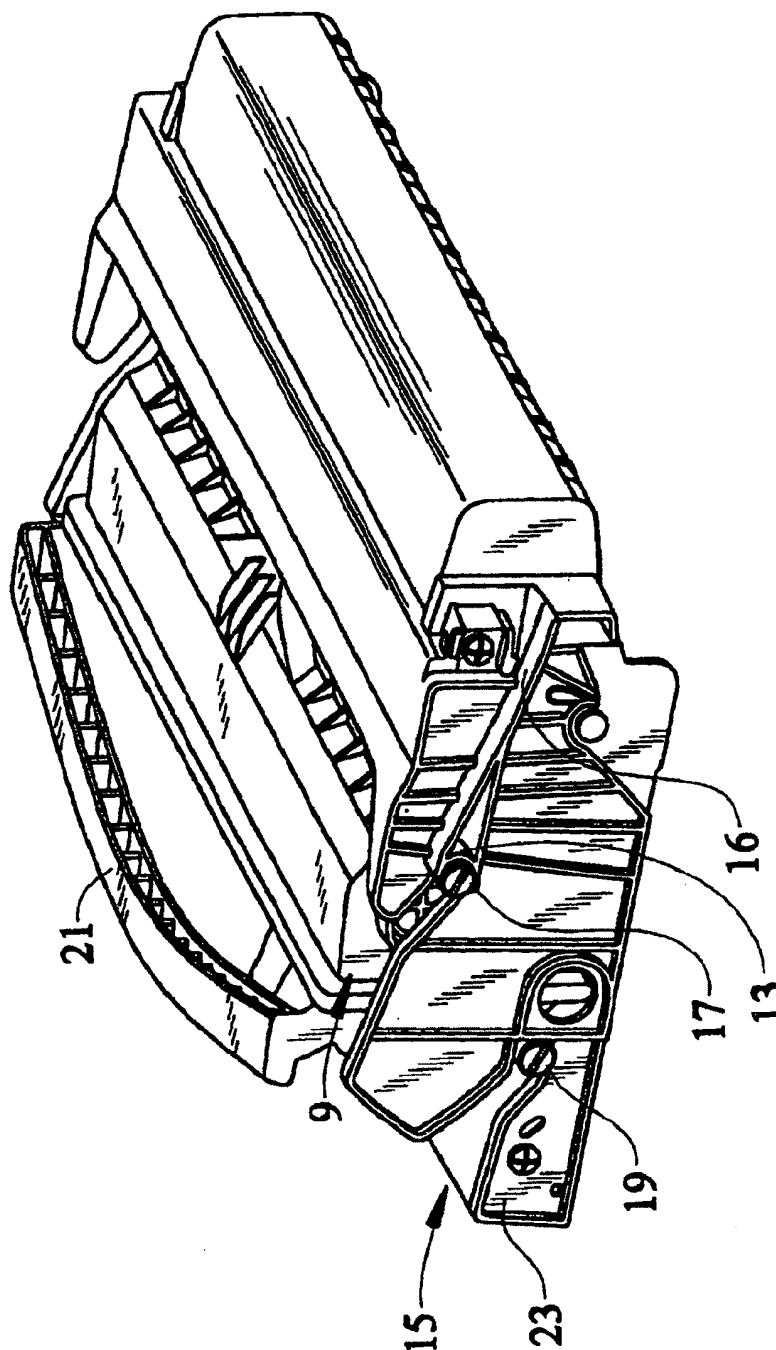
U.S. Patent

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FIG. 3





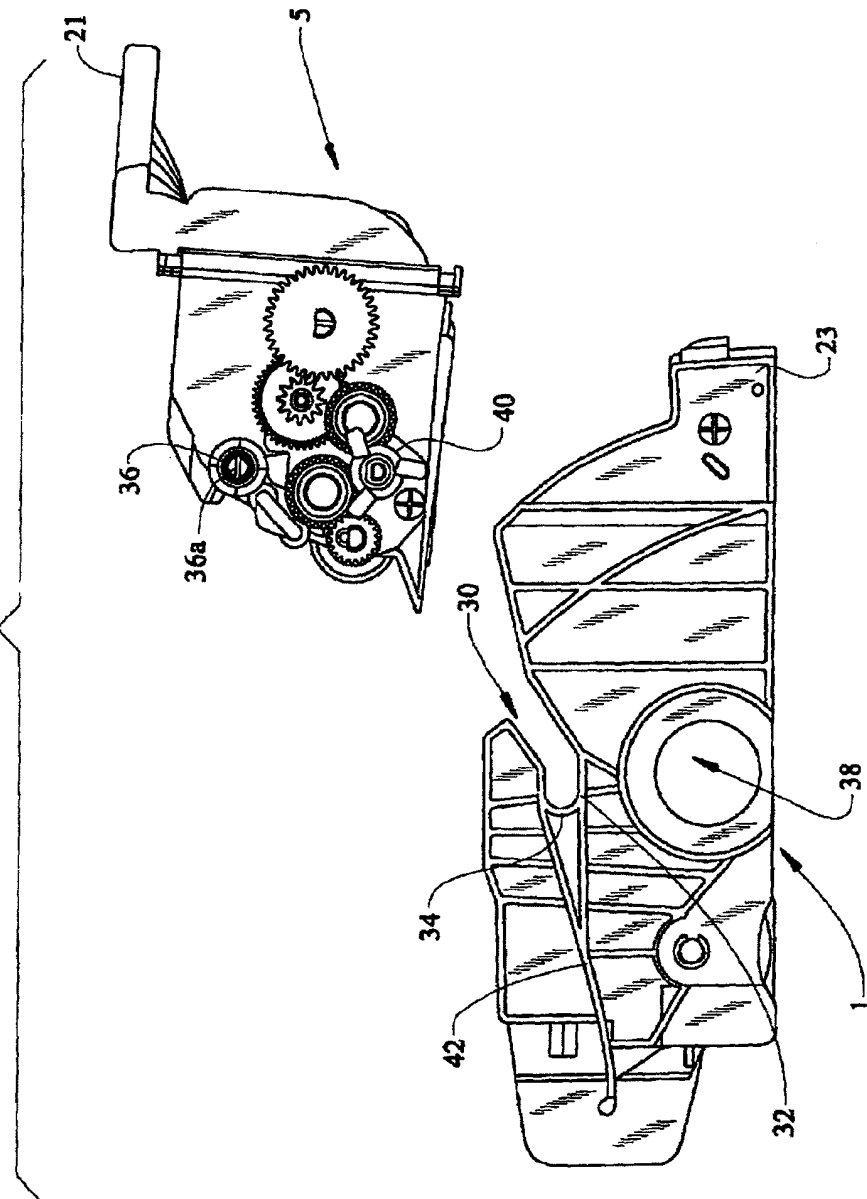
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FIG. 4





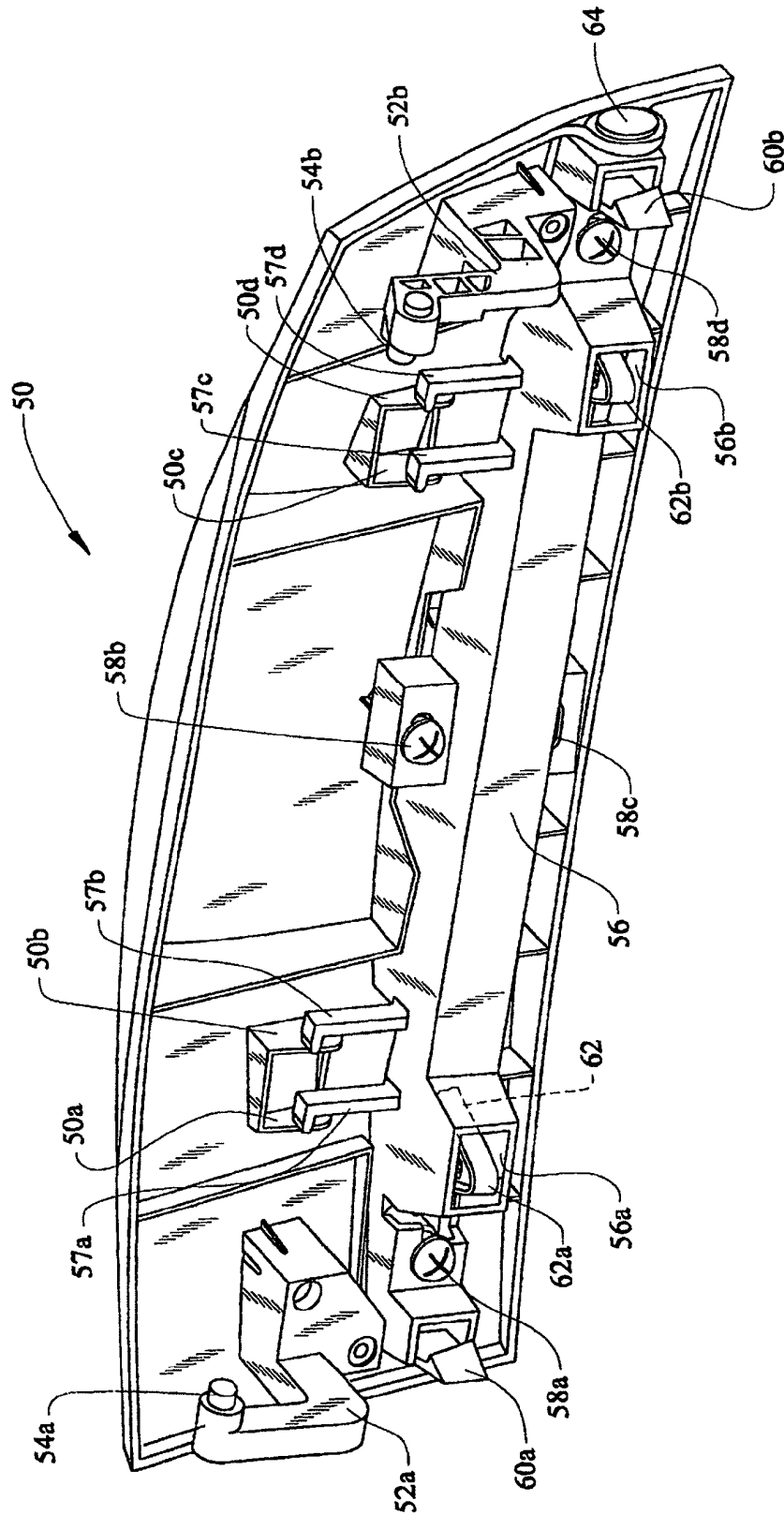
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FIG. 6



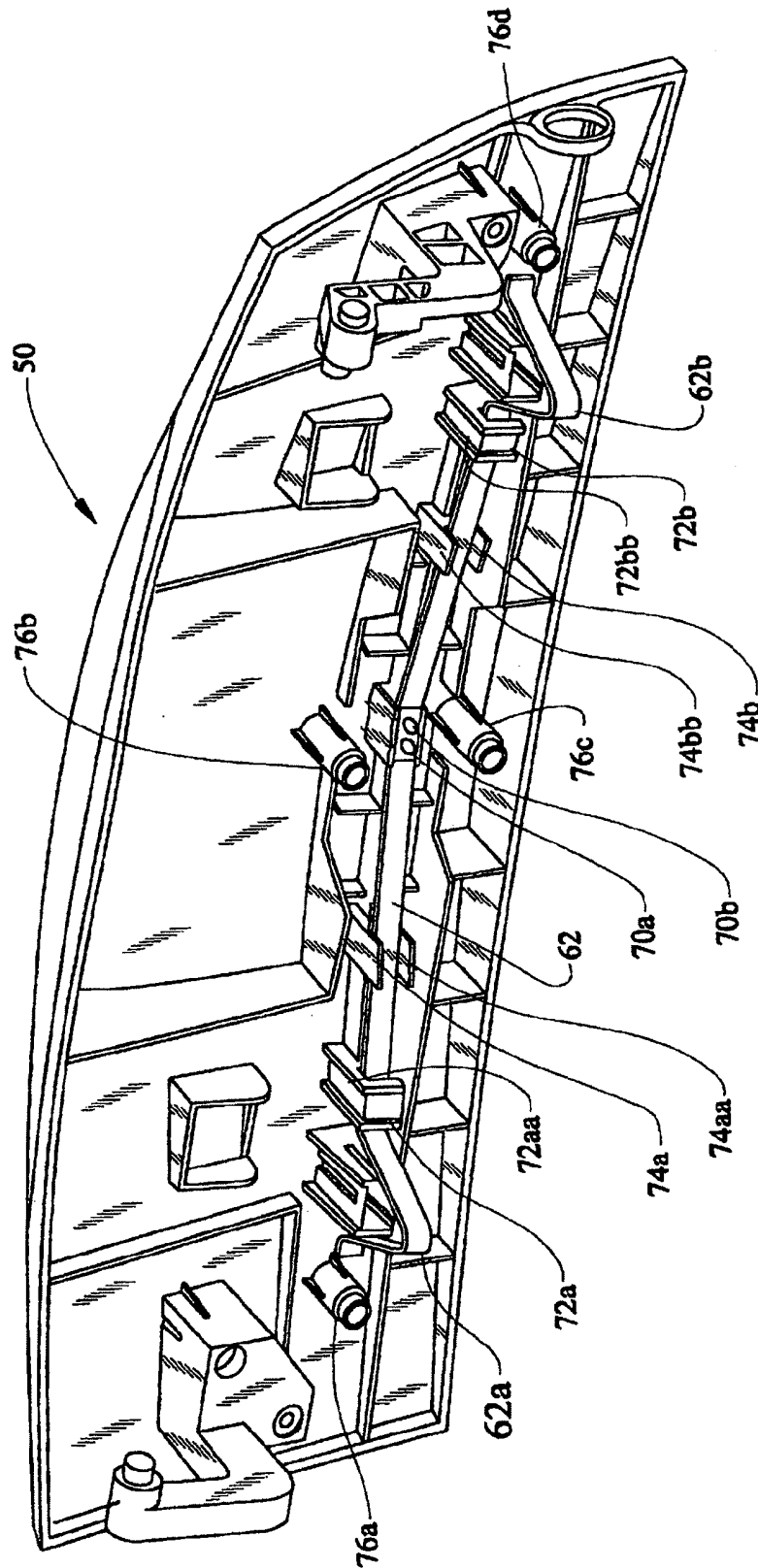
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FIG. 7



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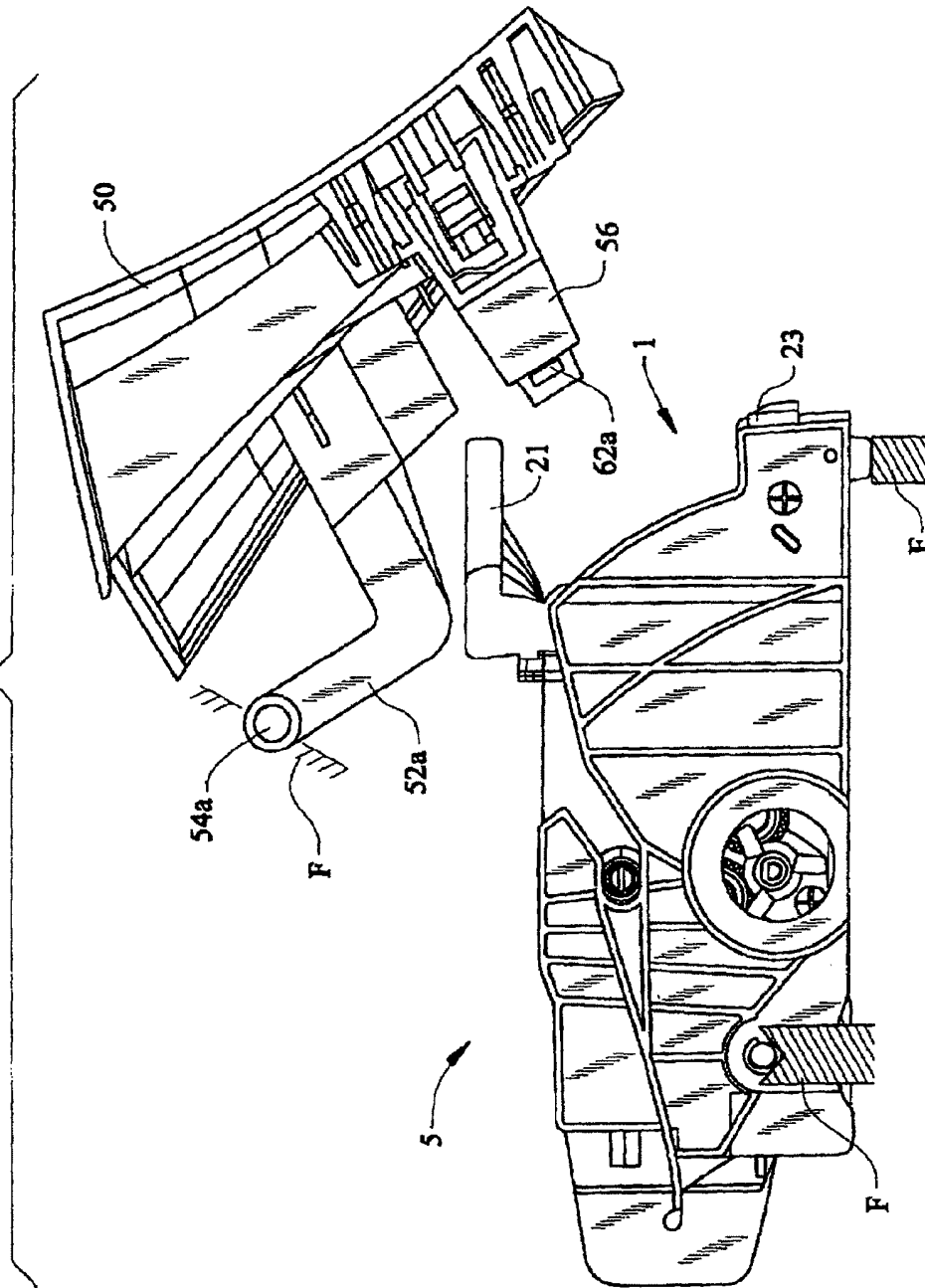
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FIG. 8



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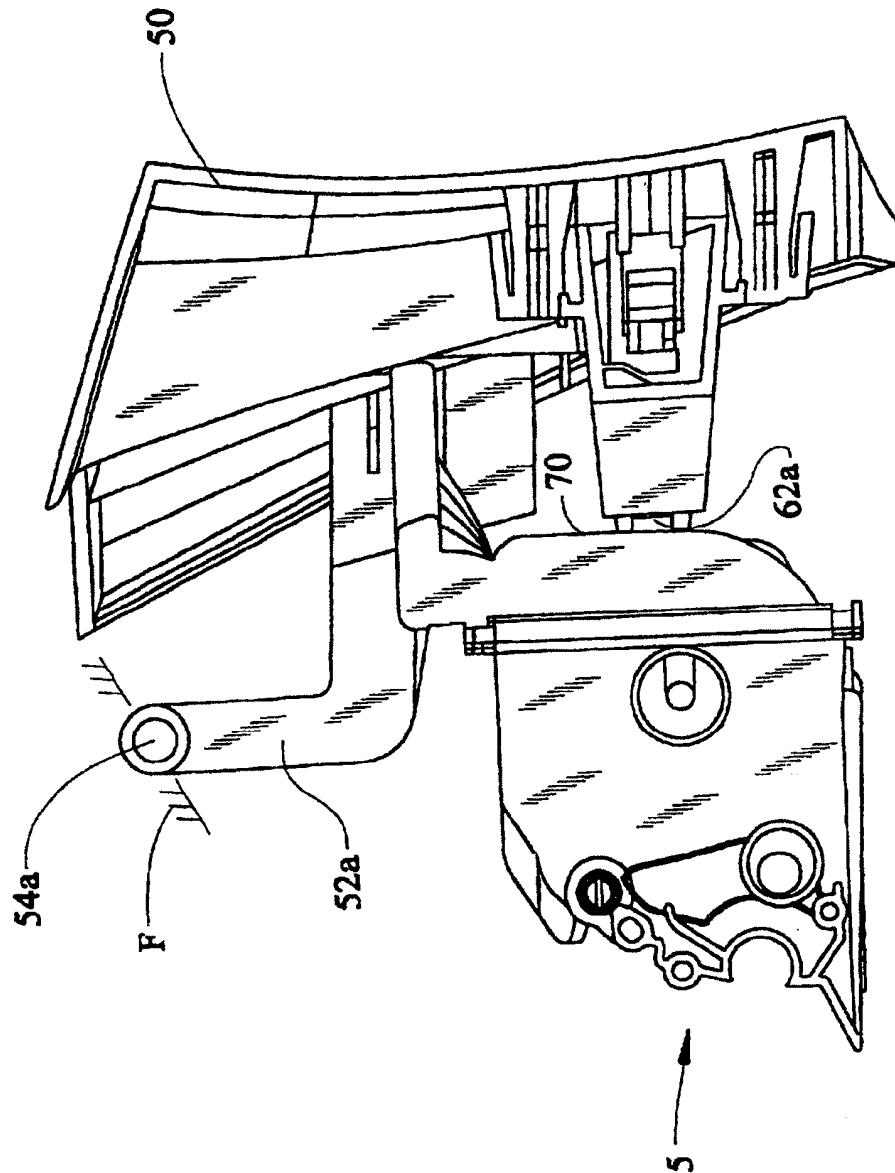
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FIG. 9





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## TWO PART CARTRIDGES WITH FORCE BIASING BY PRINTER

### CROSS REFERENCE TO RELATED APPLICATIONS

Pursuant to 37 C.F.R. § 1.78, this application is a continuation and claims the benefit of earlier filing date of application Ser. No. 10/736,355 filed Dec. 15, 2003, now U.S. Pat. No. 6,879,792, entitled "Two Part Cartridges With Force Biasing by Printer," which is a continuation of application Ser. No. 10/195,270 filed Jul. 15, 2002, now U.S. Pat. No. 6,678,489.

### TECHNICAL FIELD

This invention relates to electrophotographic imaging and, more particularly, relates to separate replaceable cartridges for toner and photoconductor, which are pressed together for good operation when installed in the imaging device.

### BACKGROUND OF THE INVENTION

Electrophotographic toner cartridges are often joined in two sections pivoted to one another so that a developer roller can be pressed against a photoconductor drum with controlled pressure. The controlled pressure is provided by permanently installed springs stretching between the two sections. The two sections are not normally separated, so such cartridges can be said to be one part cartridges.

Such one part cartridges have the advantage of having the spring force installed at the factory manufacturing the cartridge and having a relatively short duration during which the springs need provide the correct pressure, since the entire cartridge is refurbished (or discarded) after use of the original cartridge. Such one-piece cartridges have the disadvantage that the springs must be included on each cartridge. Also, for such one piece cartridges, replacement of the toner with a new section having the toner is not practical since the sections are not readily separated.

Two part cartridges are known in which a part having the toner is readily separated from a part having the photoconductor drum, since they are not pivoted to one another. To install such two part cartridges for imaging, they are manually brought together by the operator, and then the operator activates a latching mechanism, such as a resilient latch or a lever of some kind, to force the two parts together with the appropriate pressure for imaging.

A disadvantage of such known two part cartridges is that the forcing mechanism must be on one or both of the two parts and therefore adds to supplies costs, as both of the two parts are typically replaceable as they are worn (in the case of the photoconductor and other physical parts) or expended (in the case of the toner). Another disadvantage is that operator involvement requires training or some skill, and requires an overall design which permits the operator to reach the latching mechanism and activate it or deactivate it. A further disadvantage is that the force biasing elements require some space in the body of the imaging device.

### DISCLOSURE OF THE INVENTION

This invention provides for two part cartridges which have no mechanism to latch the cartridges together. Biasing force during use is provided from the cover of the imaging device when closed. The two parts need only have conform-

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ing external configurations so that they fit together, and require no space in the middle of the printer for a force biasing element. No operator involvement in forcing the two parts together is required except for inserting the cartridges in the imaging device and closing the cover of the imaging device. Although the biasing by the cover may be by a spring or springs more costly than springs or other forcing mechanism which might be on the parts, over the life of the imaging device the overall costs typically will be less.

### BRIEF DESCRIPTION OF THE DRAWINGS

The details of this invention will be described in connection with the accompanying drawings, in which FIG. 1 is a perspective view from the right of the two parts of the cartridge separated; FIG. 2 is a side view from the left with covers removed showing selected parts of the two parts of the cartridge in contact when being forced together by the cover of the printer; FIG. 3 is a side view from the right of the two parts of the cartridge forced together; FIG. 4 is a side view from the left of the two parts of the cartridge separated; FIG. 5 is a side view from the left of the two parts of the cartridge forced together; FIG. 6 is a perspective view from the left showing the inside of the cover of the printer; FIG. 7 is a perspective view of the cover like the view of FIG. 6 with a housing deleted to fully show the spring mounting; FIG. 8 is a side view from the left sectioned in the middle of the cover showing the cover open and the cartridge parts installed in the printer; and FIG. 9 is a side view as in FIG. 8 showing part 5 with the cover pivoted to its final position in which it is applying a force by contacting on the toner part of the cartridge.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a replaceable cartridge part 1 containing a photoconductive drum 3 (shown in FIG. 2) is shown separated from a replaceable cartridge part 5 containing a developer roller 7 and toner (not shown). The right side of part 1 has an upper guide channel 9 ending in a flat section 11 having a rear wall 13. The right side of part 1 also has a lower guide channel 15. Planar member 16 is a guide for installation in a printer.

The right side of part 5 has an upper guide stud 17 and a lower guide stud 19. FIG. 3 shows the two parts 1 and 5 forced together in accordance with this invention. Guide stud 17 fits in channel 9 but does not reach wall 13. Similarly, guide stud 19 fits in channel 15. Channels 9 and 15 direct the guide studs 17 and 19 respectively to bring developer roller 7 in contact with photoconductor drum 3 (FIG. 2).

Part 5 has an upper handle 21, which can be readily grasped by an operator to pull part 5 away from part 1. Part 1 has a lower handle 23 which extends past part 5 when the two are combined (FIG. 2). Handle 21 and handle 23 can be grasped and pulled by an operator to pull out part 1 and part 5.

Since part 5 contains toner used for imaging, part 5 will be extracted and replaced with a replacement part 5 having toner more frequently than part 1 will be replaced. Part 1 will be extracted and replaced with a replacement part 1 when the photoconductor becomes deteriorated or when excess toner fills the compartment in part 1 for toner cleaned from the photoconductor 3 (such cleaning is standard).

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Referring to FIG. 4, the two parts 1 and 5 are shown from the left side separated. Part 1 has a guide channel 30 ending in a flat section 32 having a rear wall 34. Part 5 has a guide stud 36. The cover of part 1 has an opening 38 to provide external access to driven coupling 40 when part 5 is pressed against part 1 (FIG. 5). Planar member 42 is a guide for installation in a printer, as is standard.

The action of the drive coupling and the gears shown will not be described in detail as they are essentially standard for imaging by driving known parts, not shown, including a toner adder roller and a toner mixing paddle, as well photoconductor drum 3 and the developer roller 7. Similarly, with reference to FIG. 2, spring 46 biasing a change roller 48 against photoconductor 3 is standard and will not be further discussed.

FIG. 5 shows parts 1 and 5 from the left forced together in accordance with this invention. Guide stud 36 fits in channel 30 but does not reach wall 34. Channel 30 directs stud 36 to bring developer roller 7 in contact with photoconductor drum 3 (FIG. 2). Driven coupler 40 is located in opening 38 (FIG. 4) for access by a printer drive coupler (not shown).

Guide studs 17, 19 and 36 are external caps of DELRIN 500 polyacetal, a hard plastic, mounted on shafts integral with the body of part 5. The body of part 5 is made of polystyrene. Openings 17a, 19a (FIG. 1) and 36a (FIG. 4) permit flexing of the shafts. The DELRIN polyacetal caps have a circumferential groove which meshes with small, radial tongues (not shown) extending into the grooves of the caps to thereby form studs 17, 19 and 36. The caps are free to rotate, but they may simply slide without loss of important function with respect to this invention. Alternative materials and construction of studs 17, 19 and 36 could be readily employed.

Referring to FIG. 6, the inside of printer cover 50 is shown, which may be made of a standard, strong plastic. Mounted on opposite sides of cover 50 are pivot arms 52a and 52b, having near their ends pivot studs 54a and 54b. Pivot studs 54a and 54b enter frame F (FIG. 8) of the printer (only frame of printer illustrated in this description) to define fixed pivot points of cover 50 relative to the frame F.

Mounted on the inside of cover 50 is one-piece housing 56, mounted to cover 50 by four screws, 58a-58d. Housing 56 has latching members 60a and 60b on opposite sides of cover 50. Primarily significant to this invention, housing 50 confines a leaf spring 62, having opposed bent ends 62a and 62b which extend past housing 56 at openings 56a and 56b on opposite sides of cover 50.

Housing 56 has integral, upward extending arms 57a-57d, which contact cover extensions 50a-50d. Screws 58a-58d are located in lateral, oval slots in housing 56. Integral with housing 56 on the left is a flat, pressing surface or "button" 64. When cover 50 is closed, latching members 60a and 60b are pushed leftward by arms 57a-57d acting on extensions 50a-50d. An operator pushing on button 64 overcomes this force and frees latches 60a and 60b to allow cover 50 to open.

FIG. 7 is the same view as FIG. 6 with housing 56 and its integral parts deleted so as to better show spring 62 and its mounting. In this embodiment, spring 62 is a single leaf spring held against cover 50 by two screws 70a, 70b located at the center of spring 62. Spring 62 is held against undue movement away from cover 50 by spaced ledge members 72a, 72b on cover 50. Spring 62 is confined from undue movement laterally by the extensions 72aa and 72bb holding ledge members 72a and 72b and by upper and lower

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spaced ledges 74a, 74aa and 74b and 74bb. Mounting posts 76a-76d receive screws 58a-58d (FIG. 6).

FIG. 8 shows cover 50 open and the full cartridge of parts 1 and 5 in its installed position on the printer, illustrated as frame elements F. The installed parts are held against further movement away from cover 50 by being blocked by frame F.

FIG. 9 omits cartridge part 1 to better illustrate cartridge part 5. Part 5 is also in the installed position as shown in FIG. 8. In this position part 1 has a substantially vertical front wall 70. Upon closing of cover 50, the ends 62a and 62b encounter front wall 70 of cartridge part 5 and press it against part 1. As discussed with respect to FIG. 8, the installed cartridge parts 1 and 5 are held against movement away from door 50 by frame members of the printer. Latch members 60a and 60b flex past ledges (not shown) in the frame F and then latch over the ledges,

#### VARIATIONS AND ALTERNATIVES

Although spaced spring contacts as in the foregoing embodiment tend to minimize variations between printers from differences within accepted tolerance, clearly a single leaf spring mounted in the center is an alternative. Of course, two spaced coil springs is an alternative. Other members can provide resilience, such a urethane rubber pads. Instead of spaced contacts, a wide, resilient pad could provide the force biasing. In sum, this invention is not deemed limited by the details of the biasing member operating from the cover. The cover could provide a linkage to move a separated biasing member with movement of the cover, although this normally would be more expensive than simply mounting the biasing member on the cover.

A modification of the foregoing under consideration is to replace spring 62 by two, separate leaf springs, each originating near the middle of cover 50 and terminating as shown in the foregoing.

Although the cover in the foregoing embodiment opens from the bottom, a clear alternative would be to hinge the cover on the bottom so that it opens from the top.

Other variations and alternatives will be readily apparent or can be anticipated.

What is claimed is:

1. A replaceable cartridge part for a two part print cartridge comprising:
  - a body having a reservoir for storing toner;
  - a developer member for controlling the amount of toner deposited on a photoconductive member;
  - guide members extending from said body for securing the toner containing cartridge part to a part containing the photoconductive member, said guide members comprising first and second guide studs which form caps mounted on shafts integral within said body; and
  - openings for permitting said shafts to flex.
2. The replaceable cartridge part of claim 1 wherein said body has a substantially vertical wall.
3. The replaceable cartridge part of claim 1 further comprising a handle coupled to said body.
4. The replaceable cartridge part of claim 1 wherein said caps are positioned in a higher and lower position about said body and arranged to fit into channels of said part containing the photoconductive member.

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5. The replaceable cartridge part of claim 1 wherein said caps are free to rotate.

6. A replaceable cartridge part for a two part print cartridge comprising:

a body providing a toner reservoir and first and second guide members extending from said body for securing the replaceable cartridge part to a second part of a print cartridge, wherein said first and second guide members comprise first and second guide studs that form caps mounted on shafts integral within said body; and openings for permitting said shafts to flex.

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7. The replaceable cartridge part of claim 6 wherein said body has a substantially vertical wall.

8. The replaceable cartridge part of claim 6 further comprising a handle coupled to said body.

9. The replaceable cartridge part of claim 6 wherein said caps are positioned in a higher and lower position about said body and arranged to fit into channels of said second part.

10. The replaceable cartridge part of claim 6 wherein said caps are free to rotate.

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U.S. PATENT: 7,233,760

ISSUE DATE: June 19, 2007

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T. LAWRENCE  
Certifying Officer







US007233760B2

(12) **United States Patent**  
**Buchanan**

(10) **Patent No.:** **US 7,233,760 B2**  
(45) **Date of Patent:** **Jun. 19, 2007**

(54) **METHOD AND DEVICE FOR DOCTOR  
BLADE RETENTION**

(75) Inventor: **John Andrew Buchanan**, Paris, KY  
(US)

(73) Assignee: **Lexmark International, Inc.**,  
Lexington, KY (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/010,495**

(22) Filed: **Dec. 13, 2004**

(65) **Prior Publication Data**

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(51) **Int. Cl.**  
**G03G 15/08** (2006.01)

(52) **U.S. Cl.** ..... **399/284**

(58) **Field of Classification Search** ..... **399/284,**  
**399/274**

See application file for complete search history.

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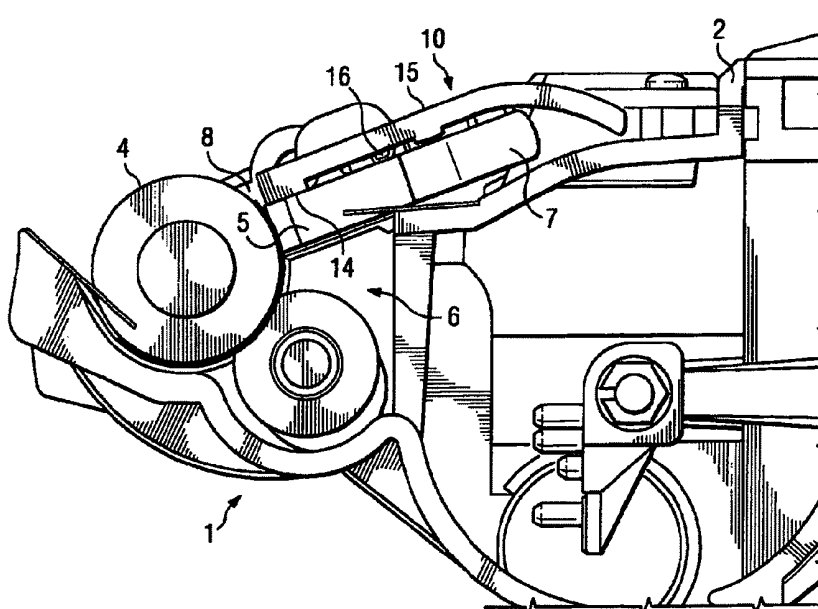
*Primary Examiner*—Quana Grainger

(74) *Attorney, Agent, or Firm*—Coats & Bennett, PLLC

(57) **ABSTRACT**

A toner cartridge for an image forming apparatus, the cartridge having: a housing defining a toner reservoir; a developer roller supported by the housing; a doctor blade supported by the housing and positioned adjacent the developer roller; and a retainer connected to the housing and positioned over a side of the doctor blade opposite the reservoir.

**14 Claims, 6 Drawing Sheets**

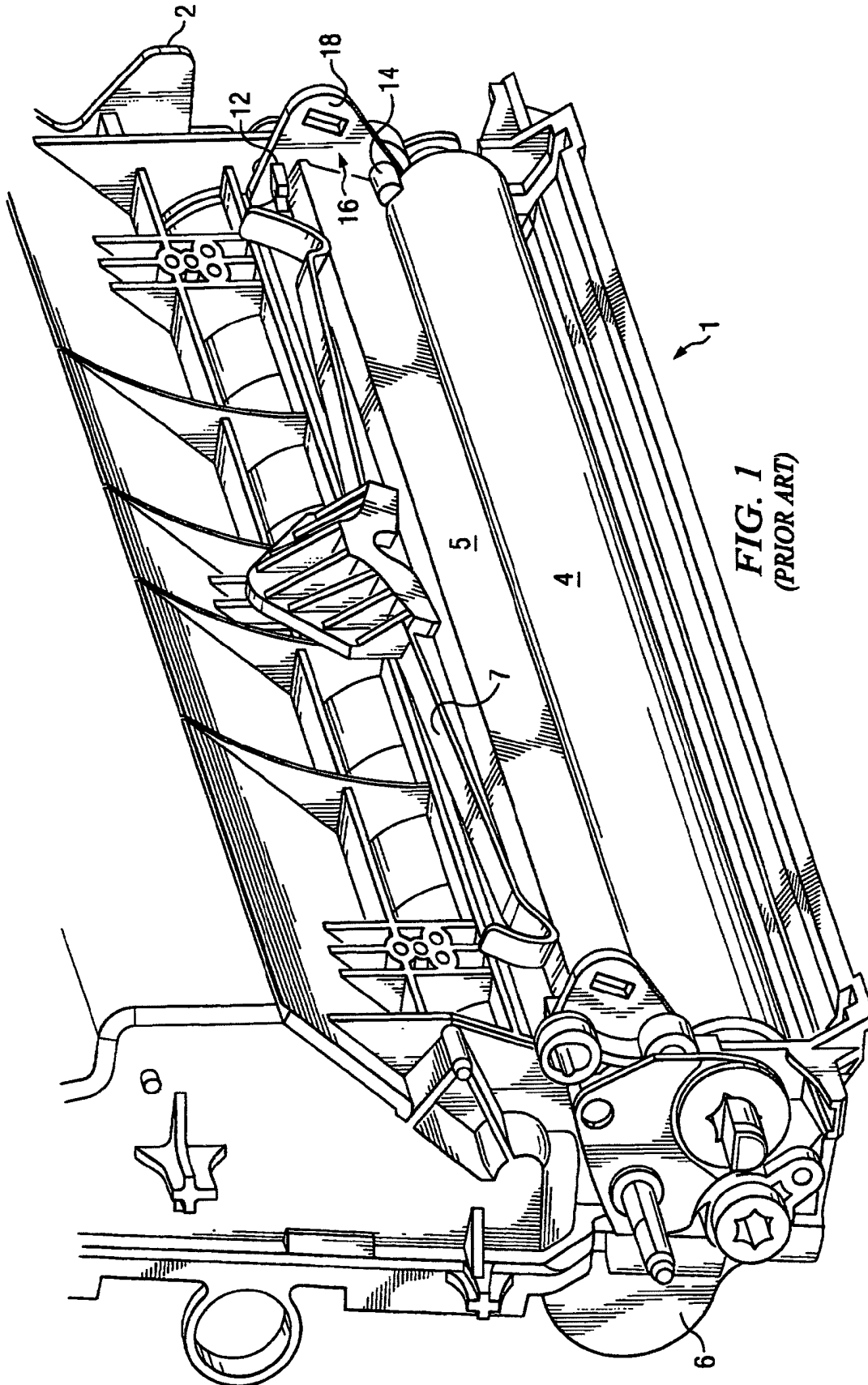


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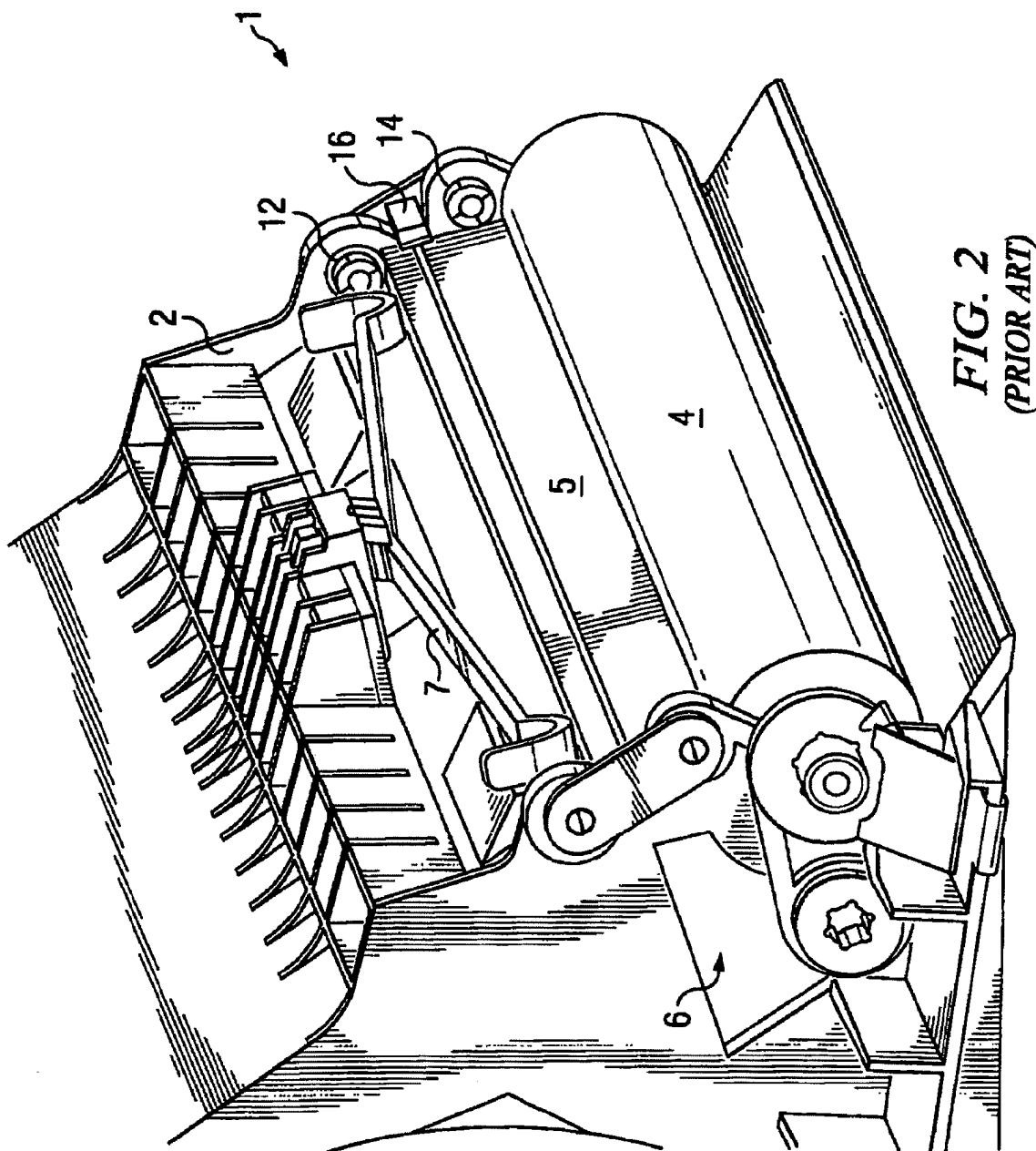


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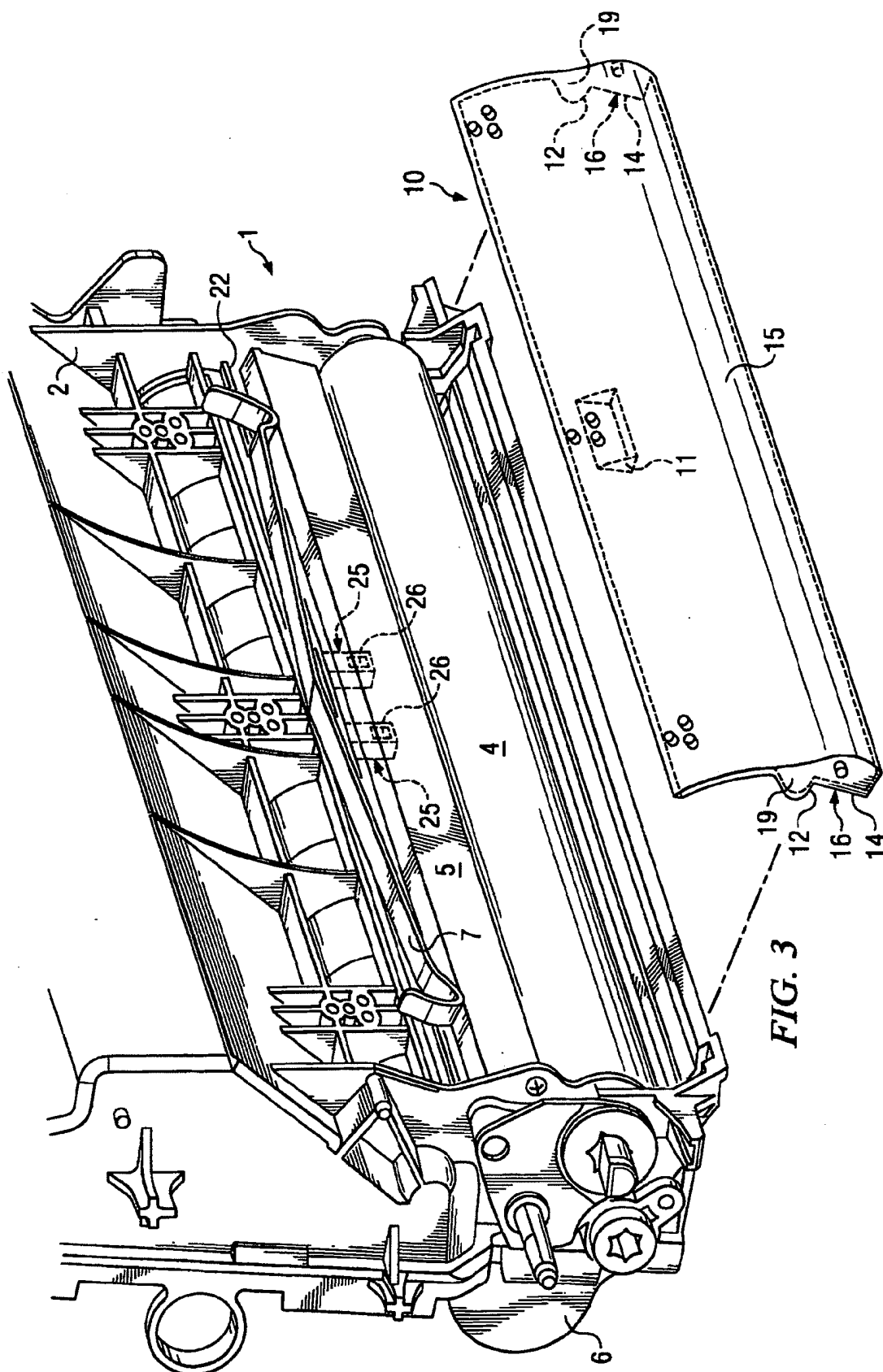
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**Jun. 19, 2007**

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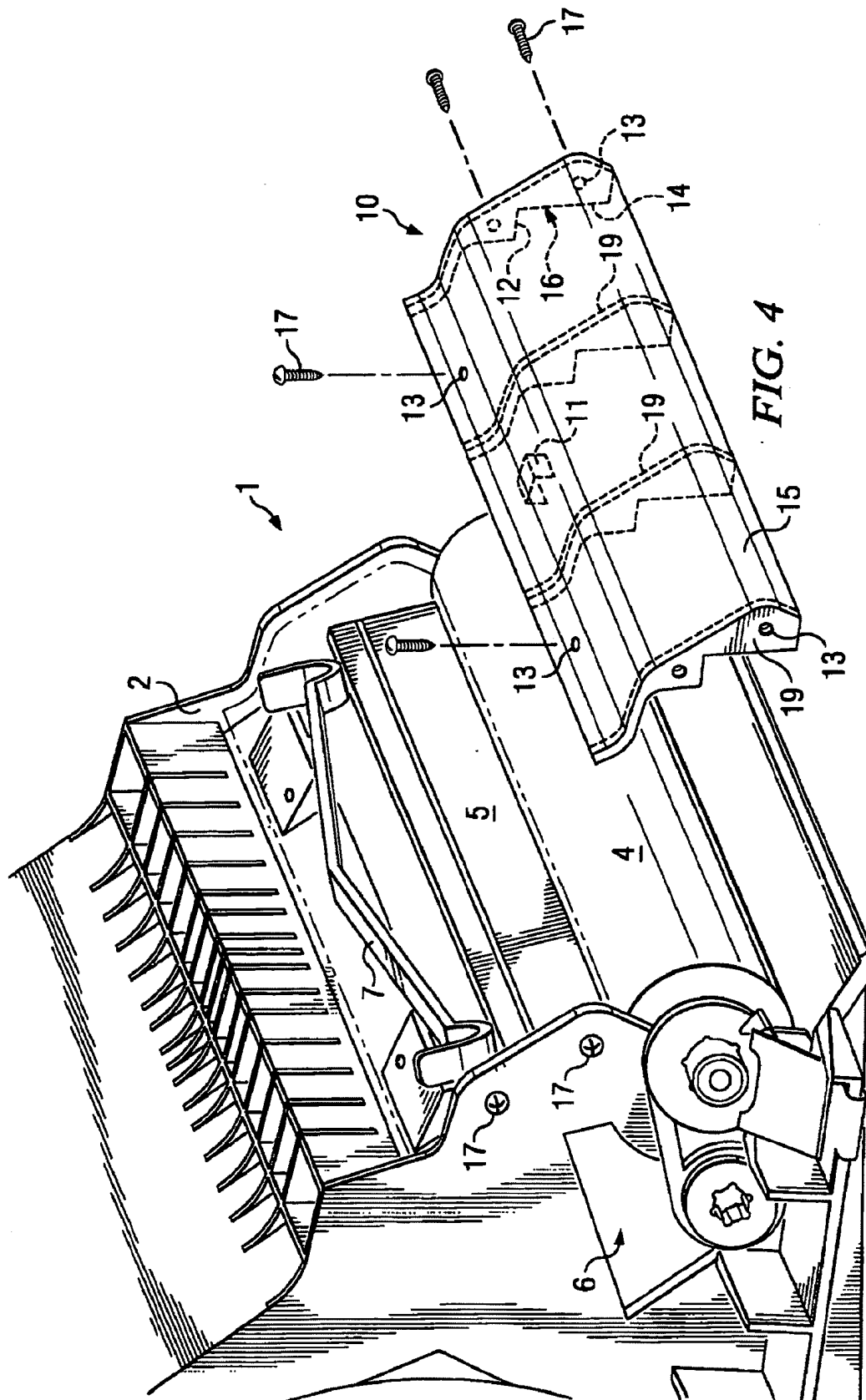


## U.S. Patent

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Sheet 4 of 6

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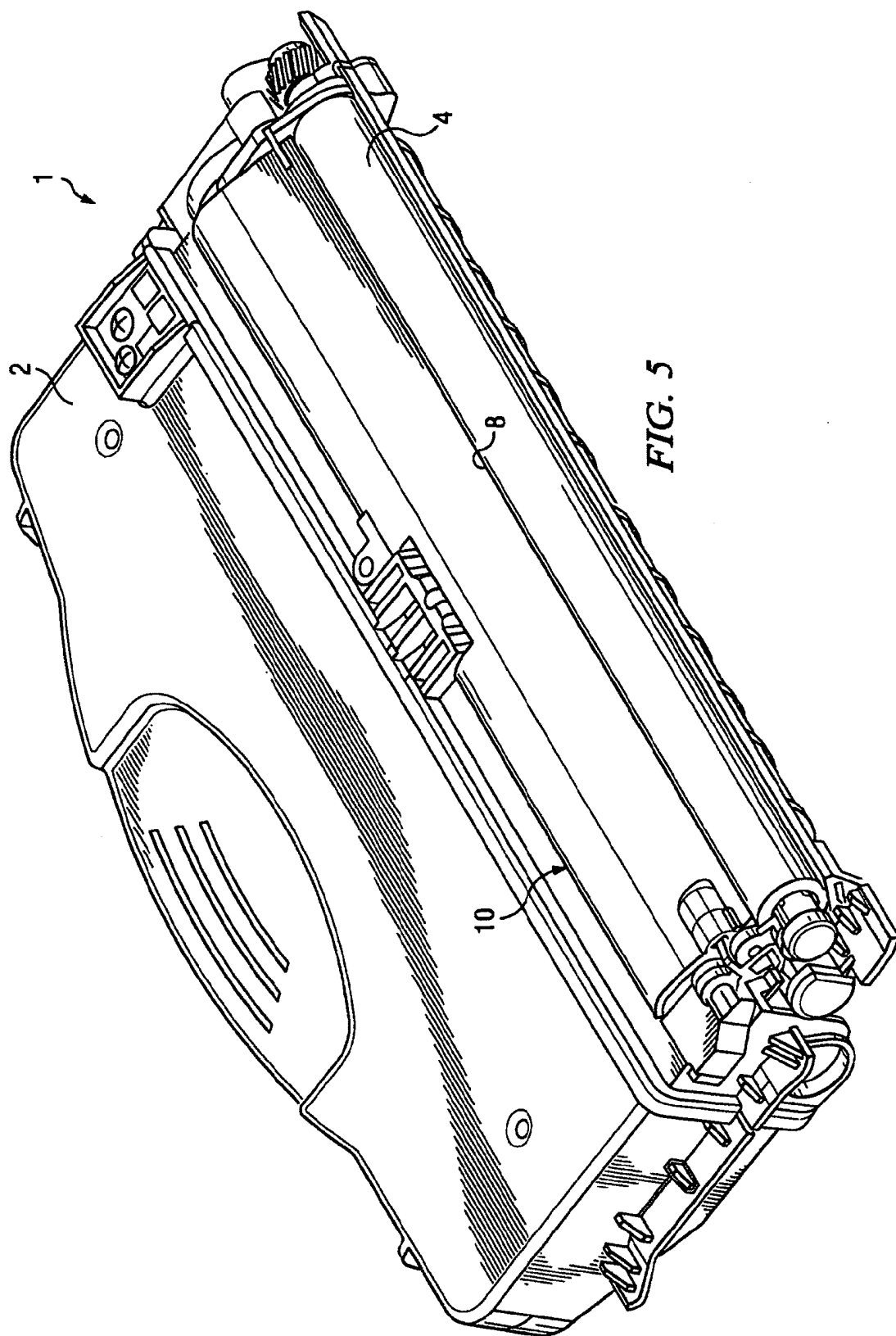
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Sheet 5 of 6

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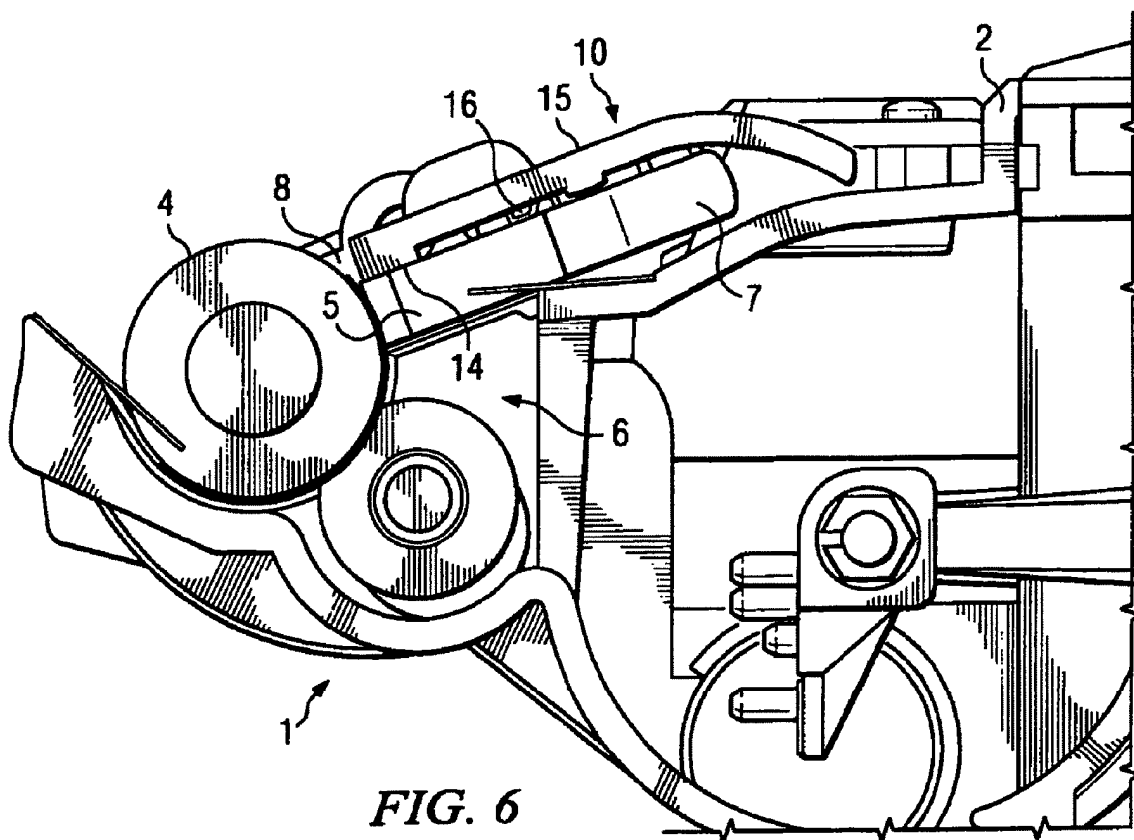


## U.S. Patent

**Jun. 19, 2007**

**Sheet 6 of 6**

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# 1

## METHOD AND DEVICE FOR DOCTOR BLADE RETENTION

### FIELD OF THE INVENTION

This invention, according to one embodiment, relates to image forming equipment, including, e.g., copiers, printers, facsimile machines and/or the like. In particular, this invention, according to an embodiment, relates to methods and devices for positioning a doctor blade against a developer roller and may prevent and/or reduce toner loss.

### BACKGROUND OF THE INVENTION

Image forming devices including copiers, laser printers, facsimile machines, and the like, include a photo conductive drum (hereinafter "photoconductor") having a rigid cylindrical surface that is coated along a defined length of its outer surface. The surface of the photoconductor is typically charged to a uniform electrical potential and then selectively exposed to light in a pattern corresponding to an original image. The areas of the photoconductive surface exposed to light are discharged, thus forming a latent electrostatic image on the photoconductive surface. A developer material, such as toner, having an electrical charge such that the toner is attracted to the photoconductive surface is used for forming the image. The toner is normally stored in a reservoir adjacent to the photoconductor and is transferred to the photoconductor by the developer roll. The thickness of the toner layer on the developer roll may be controlled by a nip, which is typically formed between a doctor blade and the developer roll. A recording sheet, such as a blank sheet of paper, may then be brought into contact with the discharged photoconductive surface and the toner therein is transferred to the recording sheet in the form of the latent electrostatic image. The recording sheet may then be heated thereby permanently fusing the toner to the sheet. In preparation for the next image forming cycle, the photoconductive surface may be discharged and residual toner removed.

FIGS. 1 and 2 illustrate typical toner housings. Developer roller 4, doctor blade 5, and toner reservoir 6 may be supported and held together by a toner cartridge housing 2. Housing 2 may be made of plastic, molded parts and may be configured to retain the internal components. In particular, housing 2 may support doctor blade 5 in, e.g., close contact with developer roller 4, and may provide a nip point that may apply a uniform layer of toner to the drum. Some toner housings 2 may also support a doctor blade spring 7 that may bias doctor blade 5 toward developer roller 4.

As shown in FIGS. 1 and 2, typical toner cartridge housings may also have a stop post 12 positioned above doctor blade 5 opposite developer roller 4. Stop post 12 may function to control the maximum movement of doctor blade 5 away from developer roller 4. Stop posts may function to ensure safety during handling of the cartridge 1, e.g., they may keep the doctor blade within the cartridge. By way of example, if the cartridge is dropped, the stop post may prevent the doctor blade from separating from the housing and possibly damaging the cartridge, image forming apparatus, or injuring a person handling the equipment.

Typical toner housings may also have a retention post 14 and a retention block 16. Retention posts 14 and retention blocks 16 may function to maintain doctor blade 5 in the proper orientation with the doctor blade lower edge positioned against developer roller 4. The post and block may work in combination and the doctor blade may contact only one or both during the toner transfer process. They may also

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function to effectively control the positioning of the doctor blade without causing friction with the doctor blade that may restrict the movement of the doctor blade to and from the developer roller. Stop posts, retention posts, and retention blocks may be constructed as a unitary piece having a common back section 18. (See FIG. 1).

### SUMMARY OF THE INVENTION

This invention, according to one embodiment, relates to image forming equipment, including, e.g., copiers, printers, facsimile machines and/or the like. In particular, this invention, according to an embodiment, relates to methods and devices for positioning a doctor blade against a developer roller while, e.g., reducing and/or preventing toner loss.

According to one embodiment of the invention, there may be provided a method for providing toner to an image forming apparatus, said method may have the following steps: applying toner from a reservoir to a developer roller; regulating the amount of toner applied to the developer roller with a doctor blade; and covering the doctor blade with a cover opposite the reservoir to retain toner.

A further embodiment of the invention provides a toner cartridge for an image forming apparatus, the cartridge may have: a housing defining a toner reservoir; a developer roller supported by the housing; a doctor blade supported by the housing and positioned adjacent the developer roller; and a retainer connected to the housing and positioned over a side of the doctor blade opposite the reservoir.

Still another embodiment of the invention, may provide a system for supporting a doctor blade, the system having: a retainer connectable to a toner cartridge housing at a position adjacent to a doctor blade opposite a toner reservoir; and a flange may extend from the retainer and engage the doctor blade.

According to a still further embodiment of the invention, there may be provided a toner cartridge for an image forming apparatus, the cartridge having: a housing defining a toner reservoir; a developer roller supported by the housing; a doctor blade supported by the housing and positioned adjacent to the developer roller; and a means for retaining toner escaping from between the developer roller and the doctor blade.

### BRIEF DESCRIPTION OF THE FIGURES

Some embodiments of the present invention may be better understood by reading the following description of non-limitative embodiments with reference to the attached drawings wherein like parts of each of the several figures are identified by the same referenced characters, and which are briefly described as follows:

FIG. 1 is a perspective view of a prior art toner cartridge having a developer roller and a doctor blade;

FIG. 2 is a perspective view of a prior art toner cartridge having a developer roller and a doctor blade;

FIG. 3 is an expanded, perspective view of a toner cartridge according to an embodiment of the invention having a retainer;

FIG. 4 is an expanded, perspective view of a toner cartridge according to an embodiment of the invention having a retainer;

FIG. 5 is a perspective view of a toner cartridge according to an embodiment of the invention having a retainer; and

FIG. 6 is a cross-sectional, side view of a toner cartridge according to an embodiment of the invention having a retainer.



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It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, as the invention may admit to other equally effective embodiments.

#### DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Referring to FIG. 3, a perspective view of a toner cartridge is illustrated. Toner cartridge 1 may have a housing 2 that supports a developer roller 4 and a doctor blade 5. A toner reservoir 6 may be retained within housing 2 behind developer roller 4. A doctor blade spring 7 may be positioned above doctor blade 5 to, e.g., bias doctor blade 5 toward developer roller 4. Toner cartridge 1 may also have a retainer 10 that mates with housing 2. Retainer 10 may have two flanges 19 that may extend from retainer 10 toward housing 2. Each flange 19 may have a stop post 12, and may have two retention points, e.g., a retention post 14 and a retention block 16. Retention post 14 may be located at the lower most end of the flange 19 below the stop post 12. And the retention block 16 may be positioned between the stop post 12 and the retention post 14.

In the illustrated embodiment, retainer 10 may also have a cover 15 that may, e.g., extend the entire length of retainer 10 to fully or partially enclose doctor blade 5 and optionally, doctor blade spring 7. Cover 15 may prevent and/or reduce toner from collecting on the external surfaces of the toner unit and may minimize the user's exposure to toner. Retainer 10 may retain doctor blade 5 in housing 2. According to certain embodiments of the present invention, retainer 10 may also retain doctor blade spring 7 in housing 2 with, e.g., a spring cleat 11. According to certain embodiments of the present invention, retainer 10, cover 15, spring cleat 11, stop post 12, retention post 14, and retention block 16 may be formed as a unitary piece. Further, according to certain embodiments of the invention, cover 15 may visually block doctor blade 5 and optionally, doctor blade spring 7 from the user's view, e.g., to provide a more integrated appearance to housing 2. In certain embodiments, cover 15 may only enclose a portion of the doctor blade 5 and/or doctor blade spring 7.

According to an embodiment of the invention, in the middle of retainer 10, a spring cleat 11 may be fixed to cover 15. Spring cleat 11 may engage and may support doctor blade spring 7 and, e.g., push doctor blade spring 7 toward doctor blade 5. If retainer 10 is attached to housing 2, doctor blade spring 7 may be supported by spring cleat 11, e.g., above doctor blade 5 to, e.g., maintain a force to bias a lower edge of doctor blade 5 against developer roller 4. The drawings illustrate doctor blade 5 substantially perpendicular to developer roller 4, however, other orientations may also provide for transfer of desired toner amounts. Doctor blade spring 7 may contact doctor blade 5 at more than one location along the doctor blade 5 to, e.g., ensure that an even and distributed force may be applied across the entire width of developer roller 4.

Retainer 10 may have a plurality of holes 13 through which fasteners may extend to secure retainer 10 to housing 2. In particular, the fasteners may be screws, rivets, guide posts or any other fastener means known to skilled persons. Housing 2 and retainer 10 may be constructed of polystyrene, or any other material known to skilled persons.

FIG. 3 also illustrates that housing 2 may have a pair of extensions 25 mounted on a housing support 22 of housing 2. In the illustrated embodiment, extensions 25 may be

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equally spaced from a centerline of housing 2. According to certain embodiments, the distance between extensions 25 may vary depending upon the parameters of the toner cartridge. According to one embodiment, the extensions may be separated by about 25 mm, but other separation distances may be utilized. Extensions 25 may have a variety of shapes and sizes. According to an embodiment of the invention, extensions 25 may be substantially rectangular in shape and may have a width of about 5 mm and may have a thickness of about 1.5 mm. According to another embodiment of the invention, a stiffening rib may extend between housing support 22 and a back of extensions 25 and may, e.g., provide additional stiffness and/or strength. According to certain embodiments of the invention, a shoulder may extend outward from the face of extensions 25 to support a dampener 26, or the dampener 26 may be adhered to the face. According to an embodiment of the invention, both extensions 25 may have the same shape, size and dimensions to equally support doctor blade 5. Any number of extensions, including a single one, may be used to support doctor blade 5.

According to an embodiment of the invention, dampeners 26 may be provided and may have a damping capacity to absorb vibrations from doctor blade 5. According to one embodiment of the invention, dampeners 26 may be constructed of a resilient material that may be compressed by doctor blade 5 and may apply a force to doctor blade 5. In relation to one embodiment of the invention, dampeners 26 may be constructed of PORON foam, a polyurethane foam commercially available from Rogers Corp. as 4790-92-2008104. According to an embodiment of the invention, only one extension includes a dampener 26.

According to an embodiment of the invention, dampeners 26 may have a thickness such that doctor blade 121 contacts dampeners 26 on a first side and a retention block 16 on the opposite side. According to one embodiment of the invention, dampeners 26 may be about 2.0 mm thick. Dampeners 26 may have a variety of shapes and sizes. According to an embodiment, dampeners 26 may be positioned on the front of the extensions 25 and may rest on a shoulder adjacent to a bottom edge of the extensions 25. According to another embodiment, dampeners 26 may have a width of about 5.0 mm. In one embodiment, dampeners 26 may be attached to extensions 25 by an adhesive that may be applied in a variety of manners. According to an embodiment, the adhesive comprises a pressure sensitive material applied to one side of dampeners 26 facing extensions 25. In relation to one embodiment of the invention, the adhesive may be Model No. 7953 manufactured by 3M. Extensions 25 may include a knurled surface to improve the adhesion of the adhesive.

According to certain embodiments of the invention dampeners 26 may be applied to retention posts 14 and/or retention blocks 16 in addition to being applied to extensions 25 or instead of being applied to extensions 25. Doctor blade 5 may also be squeezed slightly between extensions 25 and retention posts 14 and/or retention blocks 16 by adjusting the positions of the support structures relative to the thickness of doctor blade 5.

Referring to FIG. 4, a perspective view of a toner cartridge 1, according to one embodiment of the invention, is illustrated. Toner cartridge 1 may have a housing 2 and a retainer 10. Housing 2 may have contained within (i) a developer roller 4, (ii) a doctor blade 5 and (iii) a toner reservoir 6. Retainer 10 may have a cover 15 that may extend the entire length of retainer 10. Cover 15 may be contoured to fit over doctor blade 5 and optionally, doctor blade spring 7 and, e.g., may mate with housing 2. Retainer

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10 may also have four flanges 19 that may protrude from cover 15 toward, e.g., housing 2. While four flanges are illustrated, according to certain embodiments of the invention, any number of flanges may be used.

According to further embodiments of the invention, a uniform structure having a profile shaped like the illustrated flanges may extend across the entire length of retainer 10, e.g., to support doctor blade 5 at all points. As illustrated, each of flanges 19 has a stop post 12, a retention post 14, and a retention block 16. Retainer 10 may also have a spring cleat 11 to, for example, engage doctor blade spring 7. Retainer 10 may be attached to housing 2, and doctor blade spring 7 may reside within spring cleat 11, e.g., so that spring cleat 11 may press doctor blade spring 7 against doctor blade 5.

According to other certain embodiments of the invention, retainer 10 may be attached to housing 2 with, e.g., fasteners, like fasteners 17. Any number of fasteners may be used. The fasteners may extend through holes 13 in cover 15 of retainer 10 and/or through holes 13 in flanges 19. If retainer 10 is attached to housing 2, cover 15 may help reduce or prevent toner from escaping from the toner cartridge 1, e.g., when the toner cartridge is dropped or otherwise mishandled.

Referring to FIG. 5, a perspective view of a toner cartridge according to an embodiment of the invention is illustrated. In particular, toner cartridge 1 comprises housing 2 and retainer 10. Retainer 10 may be attached to housing 2 to partially and/or completely cover a doctor blade and optionally, doctor blade spring. According to certain embodiments of the invention, a small gap 8 may remain between retainer 10 and developer roller 4. According to other embodiments of the invention, gap 8 may be small enough to prevent or reduce excess toner from freely escaping from toner cartridge 1 and/or large enough so as not to interfere with charged toner properly adhering to developer roller 4.

Referring to FIG. 6, a cross-sectional side view of a toner cartridge according to an embodiment of the invention is illustrated. Toner cartridge 1 may have housing 2 and retainer 10. Housing 2 may support developer roller 4, doctor blade 5, and/or toner reservoir 6. Retainer 10 may also support doctor blade spring 7. According to an embodiment, retainer 10 may also have a retention post 14 and a retention block 16 which may engage doctor blade 5. Retainer 10 may also have a cover 15 extending partially and/or completely over doctor blade 5 and optionally, doctor blade spring 7. Retention post 14 and retention block 16 may extend from cover 15 toward doctor blade 5. Retention post 14 and retention block 16 may extend across the entire length of doctor blade 5. However, according to alternative embodiments of the invention, the retention posts may only engage doctor blade 5 at a certain point or points across its length. Retainer 10 may be attached to housing 2 and may form a gap 8 between a lower edge of retainer 10 and developer roller 4.

According to certain embodiments of the invention, a seal (not shown) may be positioned where doctor blade 5 contacts the inner side wall of housing 2 and may ensure toner does not leak between these elements and/or substantially reduces the amount of leaked toner. The seal may be a polyester film or O-ring seal; however, other seal materials may also be utilized. A flap seal (not shown) may also extend along the back side of doctor blade 5 and may prevent or reduce the leaking of toner from toner reservoir 6 to developer roller 4, that might ultimately escape the toner cartridge. The flap seal may be positioned against a back edge

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of doctor blade 5, but may not be attached if the inhibition of the relative mobility of the doctor blade 5 is not desired. The material of the flap seal may provide a low to approximately zero friction contact with doctor blade 5. According to certain embodiments of the invention, the flap seal may be constructed of a polyester film such as that sold under the trademark Mylar by DuPont. However, other low friction materials may also be used.

While the invention has been depicted and described with reference to embodiments of the invention, such a reference does not imply a limitation on the invention, and no such limitation is to be inferred. The invention is capable of considerable modification, alteration, and equivalents in form and function, as will occur to those ordinarily skilled in the pertinent arts having the benefit of this disclosure. The depicted and described embodiments of the invention are examples only, and are not exhaustive of the scope of the invention. Consequently, the invention is intended to be limited only by the scope of the appended claims, giving full cognizance to equivalents in all respects.

What is claimed is:

1. A toner cartridge for an image forming apparatus, the cartridge comprising:

a housing defining a toner reservoir;  
a developer roller supported by the housing;  
a doctor blade supported by the housing and positioned adjacent the developer roller; and  
a retainer connected to the housing and positioned over a side of the doctor blade opposite the reservoir;  
wherein the cartridge further comprises a doctor blade spring, wherein the retainer comprises a spring cleat that supports the doctor blade spring.

2. A toner cartridge for an image forming apparatus as claimed in claim 1, wherein the retainer comprises at least one flange extending toward the doctor blade.

3. A toner cartridge for an image forming apparatus as claimed in claim 1, wherein the retainer comprises a stop post positioned adjacent the doctor blade opposite the developer roller.

4. A toner cartridge for an image forming apparatus as claimed in claim 1, wherein the retainer comprises a retention post positioned adjacent to a side of the doctor blade.

5. A toner cartridge for an image forming apparatus as in claim 1, wherein the retainer comprises a retention block positioned adjacent to a side of the doctor blade.

6. A toner cartridge for an image forming apparatus as claimed in claim 1, wherein the retainer comprises a flange extending toward the doctor blade, wherein the flange comprises a stop post, a retention post, and a retention block.

7. A toner cartridge for an image forming apparatus as claimed in claim 1, wherein the retainer comprises a cover that extends over more than half of the doctor blade.

8. A toner cartridge for an image forming apparatus as claimed in claim 1, wherein the cartridge further comprises an extension from the housing that supports the doctor blade on a side of the doctor blade facing the reservoir.

9. A toner cartridge for an image forming apparatus as claimed in claim 1, further comprising an extension from the housing that supports the doctor blade on a side of the doctor blade facing the reservoir, and wherein the retainer comprises a retention post and is positioned such that the doctor blade is between the extension and the retention post.

10. A toner cartridge for an image forming apparatus as claimed in claim 1, wherein the cartridge further comprises a dampener attached to the retainer and positioned to contact the doctor blade.

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11. A system for supporting a doctor blade, the system comprising:

a retainer connectable to a toner cartridge housing at a position adjacent to a doctor blade opposite a toner reservoir;

a flange with a stop post that extends from the retainer and engages the doctor blade; and

a cover of the doctor blade for retaining toner.

12. A system for supporting a doctor blade as claimed in claim 11, wherein the flange includes a retention roost, the

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flange and the retention post each extending from the retainer and engaging the doctor blade.

13. A system for supporting a doctor blade as claimed in claim 11, further comprising a spring cleat that supports a doctor blade spring.

14. A system for supporting a doctor blade as claimed in claim 11, further comprising a dampener attached to the retainer and positioned to contact the doctor blade.

\* \* \* \* \*



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# THE UNITED STATES OF AMERICA

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United States Patent and Trademark Office

March 02, 2010

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM  
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U.S. PATENT: 7,305,204

ISSUE DATE: December 04, 2007

By Authority of the  
Under Secretary of Commerce for Intellectual Property  
and Director of the United States Patent and Trademark Office



*E. Bornetti*  
E. BORNETTI  
Certifying Officer

A4451



US007305204B2

(12) **United States Patent**  
**Carter et al.**

(10) **Patent No.:** **US 7,305,204 B2**

(45) **Date of Patent:** **Dec. 4, 2007**

(54) **TWO PART CARTRIDGES WITH FORCE BIASING BY PRINTER**

(52) **U.S. CL.** ..... 399/113; 399/107; 399/114

(58) **Field of Classification Search** ..... 399/107,  
399/111-114, 116, 117

See application file for complete search history.

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KY (US)

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(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

\* cited by examiner

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(74) *Attorney, Agent, or Firm*—Coats & Bennett, P.L.L.C.

(21) Appl. No.: **11/535,096**

(22) Filed: **Sep. 26, 2006**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2007/0019986 A1 Jan. 25, 2007

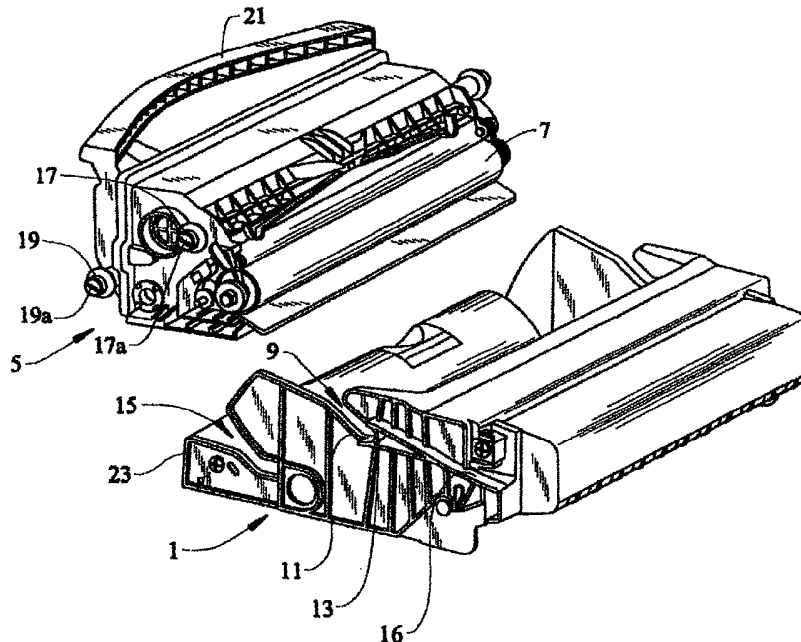
**Related U.S. Application Data**

(63) Continuation of application No. 11/057,550, filed on  
Feb. 14, 2005, which is a continuation of application  
No. 10/736,355, filed on Dec. 15, 2003, now Pat. No.  
6,879,792, which is a continuation of application No.  
10/195,270, filed on Jul. 15, 2002, now Pat. No.  
6,678,489.

A two part cartridge having a photoconductor part (1) and a  
toner part (5) having no force biasing element on either part.  
The two parts fit together so that a developer roller (7) in the  
toner part contacts a photoconductor drum (3) in the other  
part. When the two parts are installed in a printer the cover  
(50), when closed, brings a spring (62) into contact with one  
side of the toner part while the frame (F) of the printer blocks  
movement away from the cover. An advantage of the two  
part cartridge is that the toner part can be replaced without  
replacing the photoconductor part. Members on the cartridge  
for force biasing are avoided and the need for training or  
skill to latch the parts together is avoided.

(51) **Int. Cl.**  
**G03G 21/18** (2006.01)

**20 Claims, 9 Drawing Sheets**



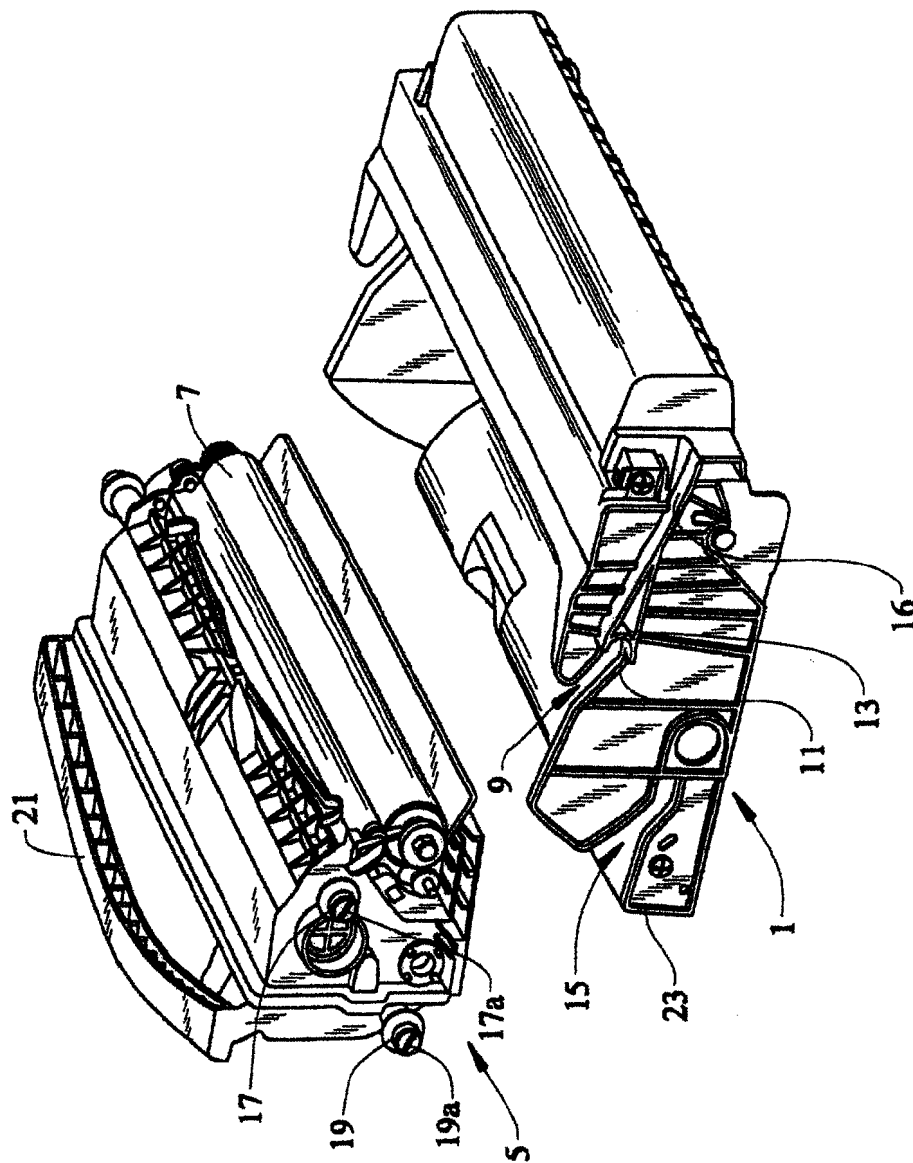




FIG. 2

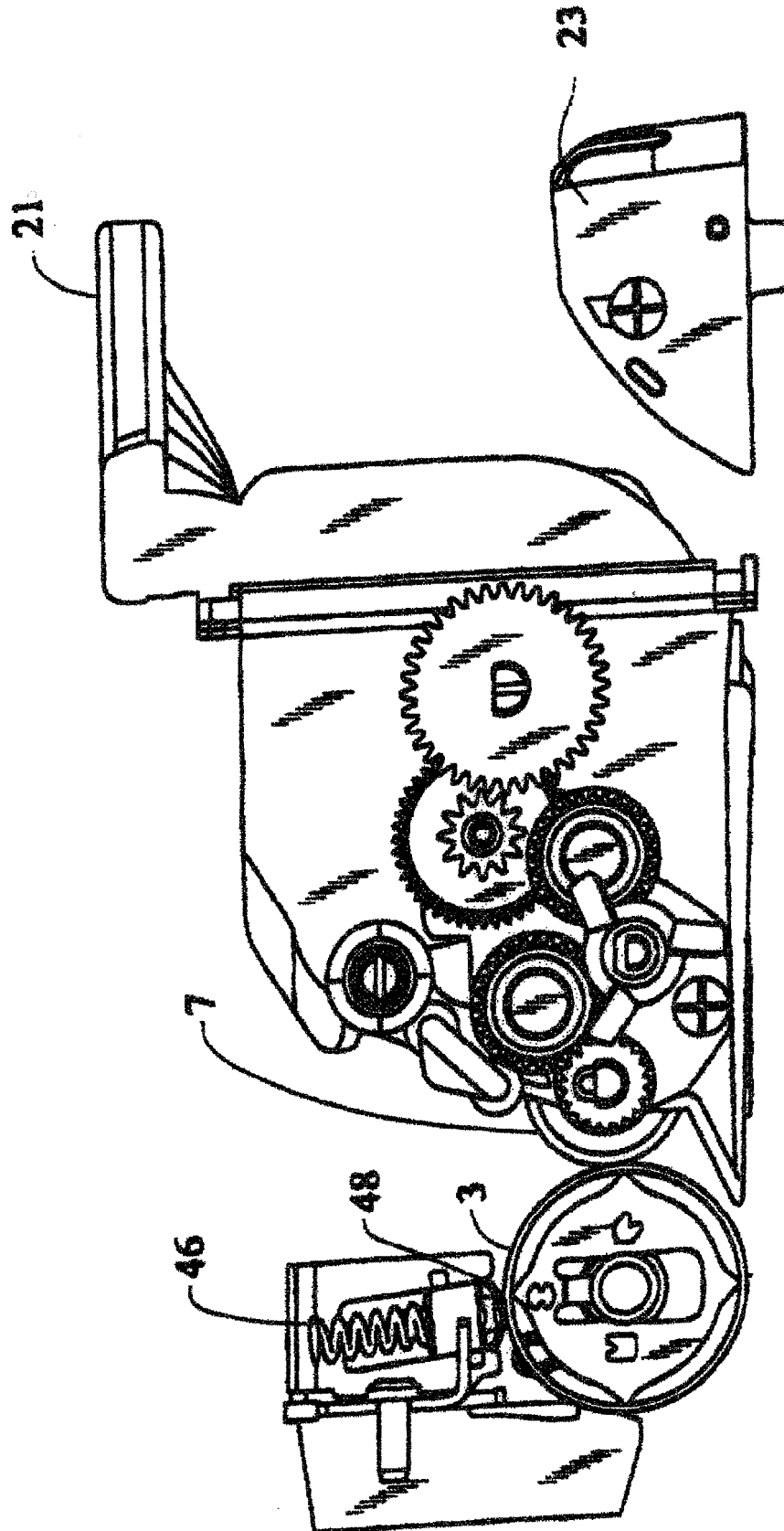


FIG. 3

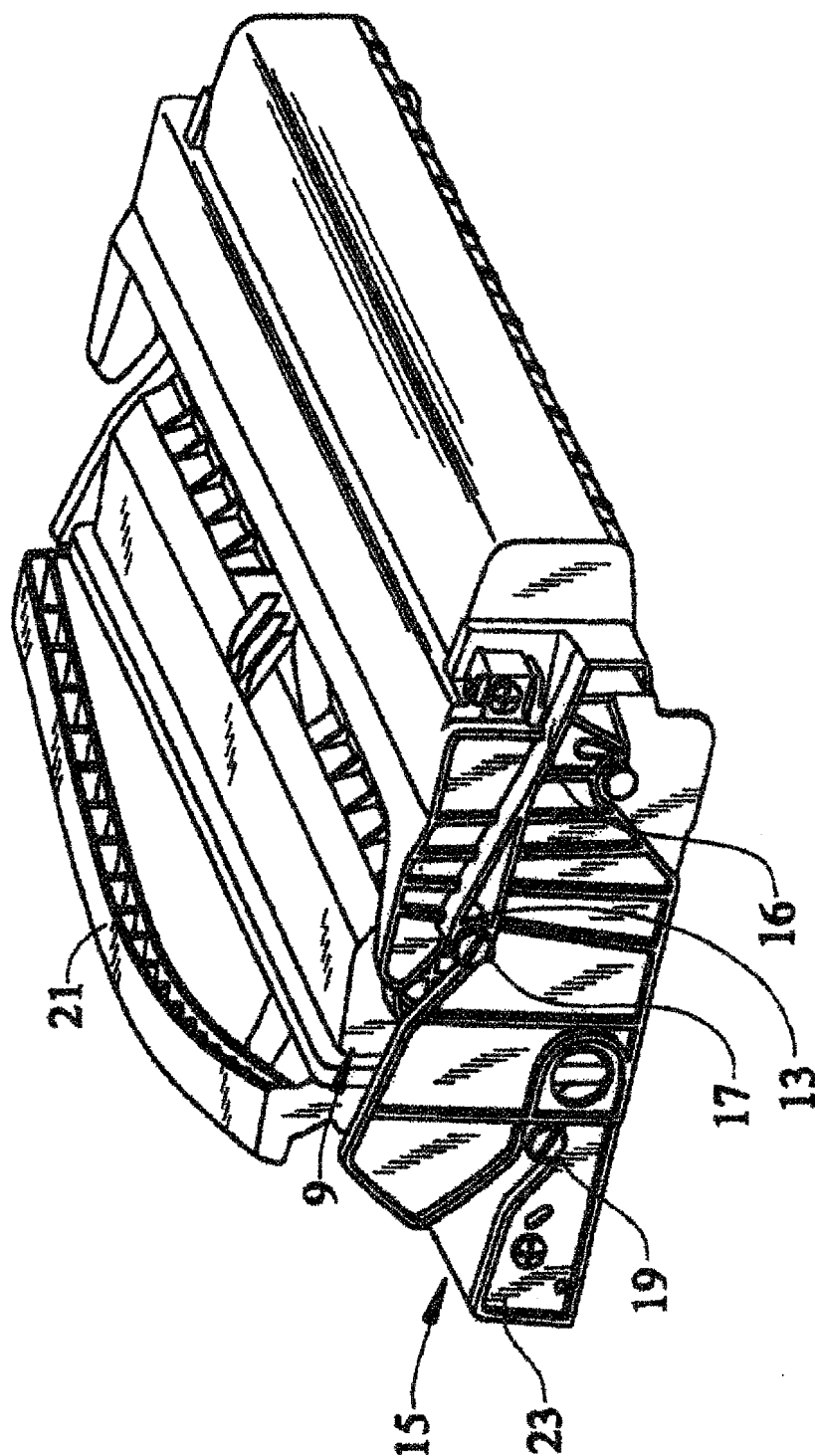


FIG. 4

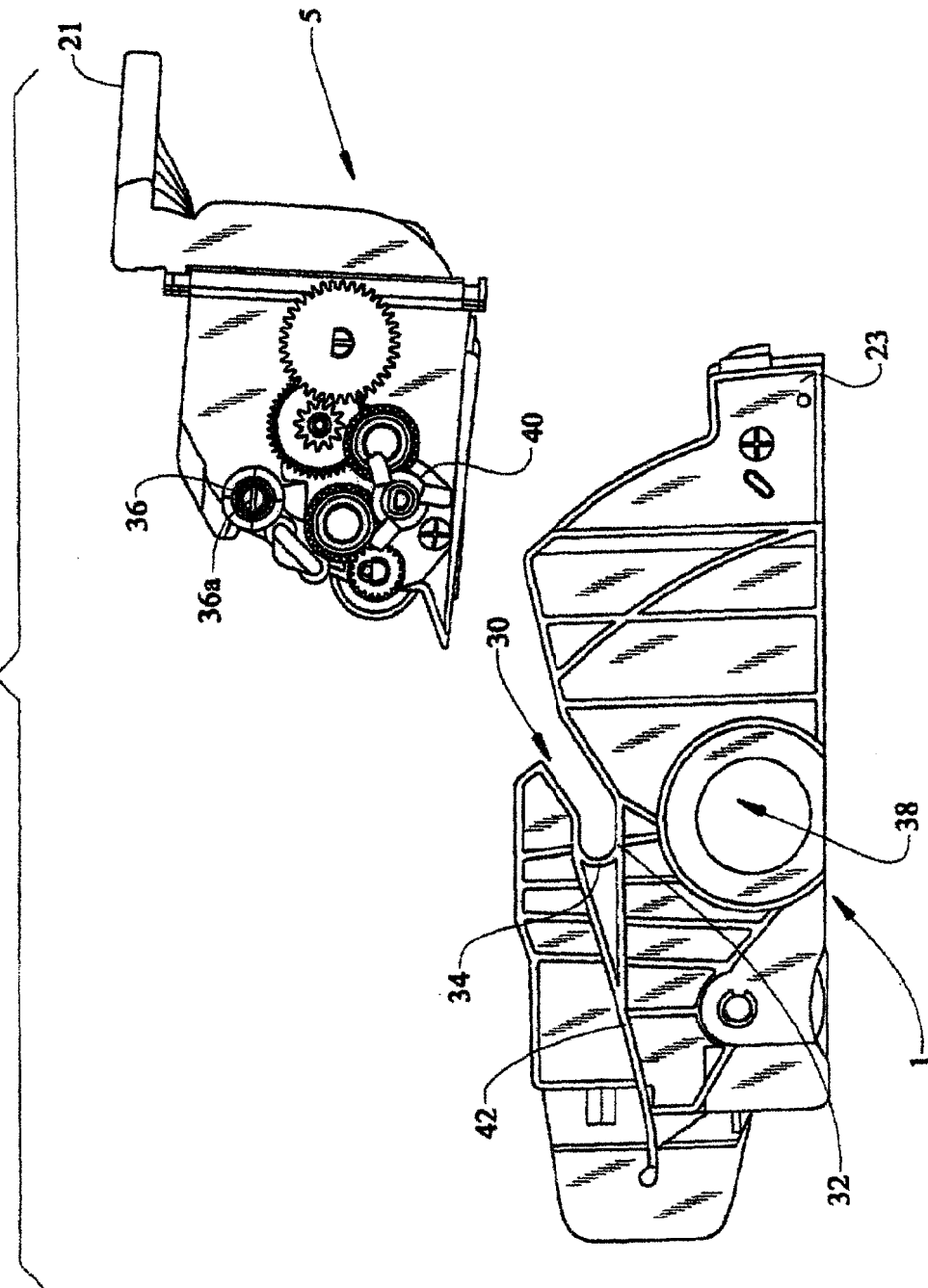


FIG. 5

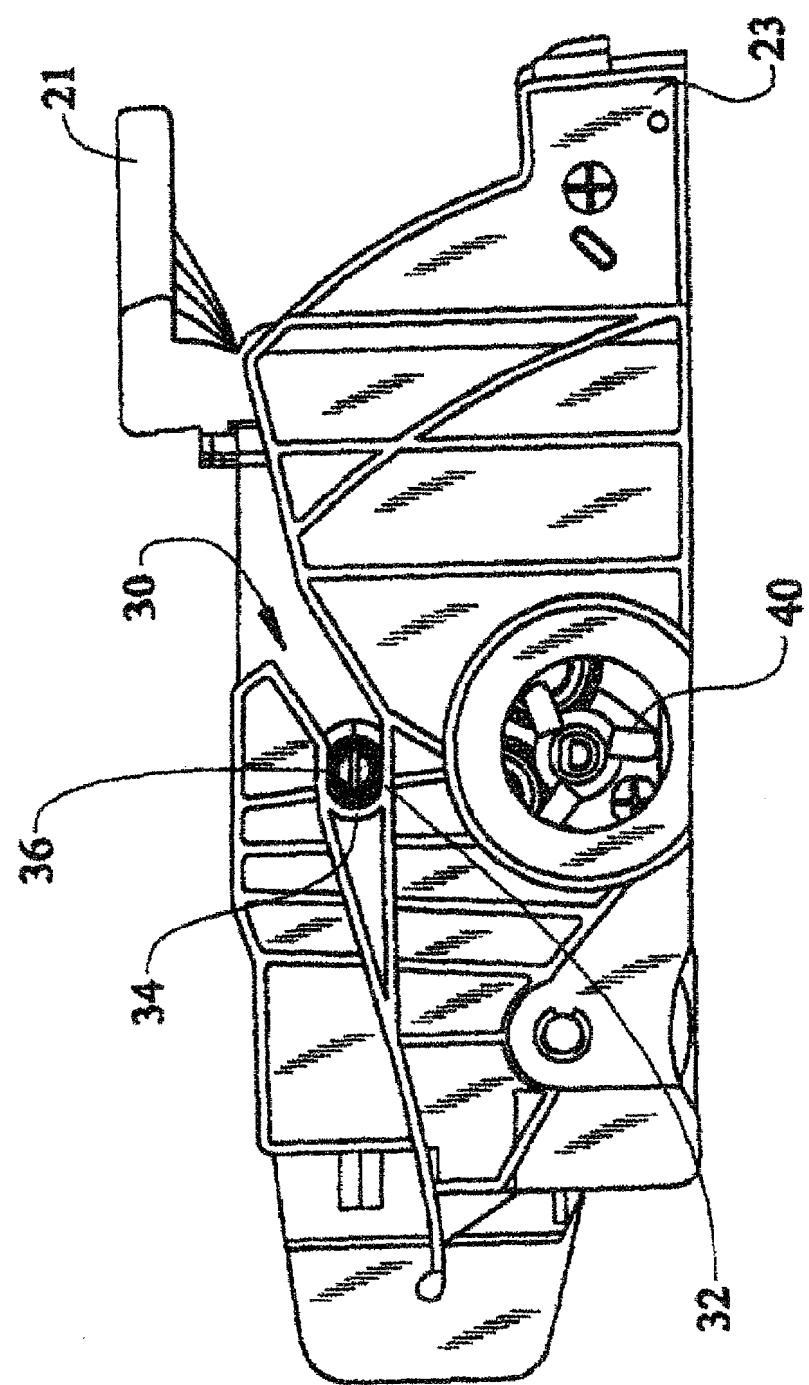


FIG. 6

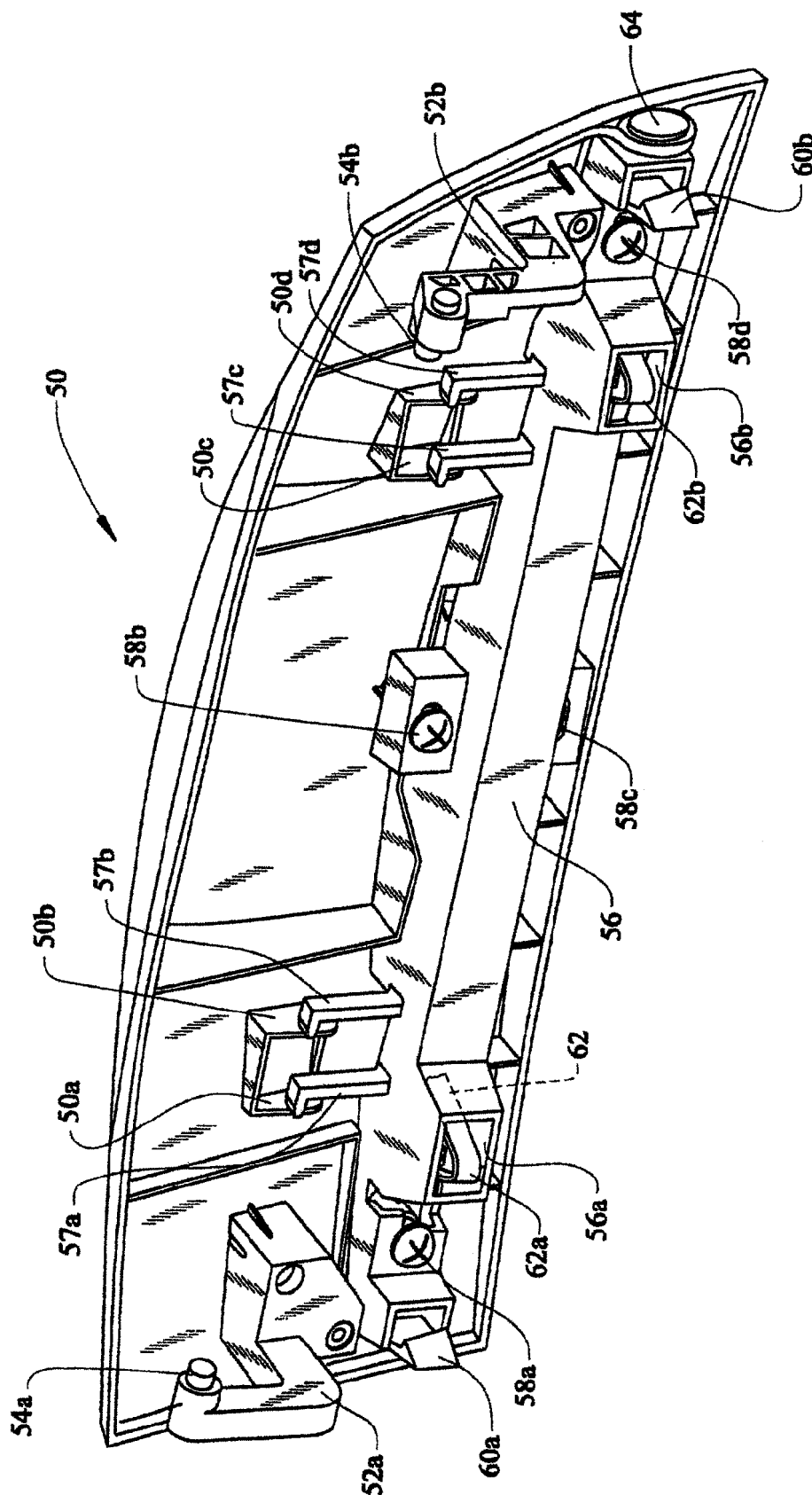
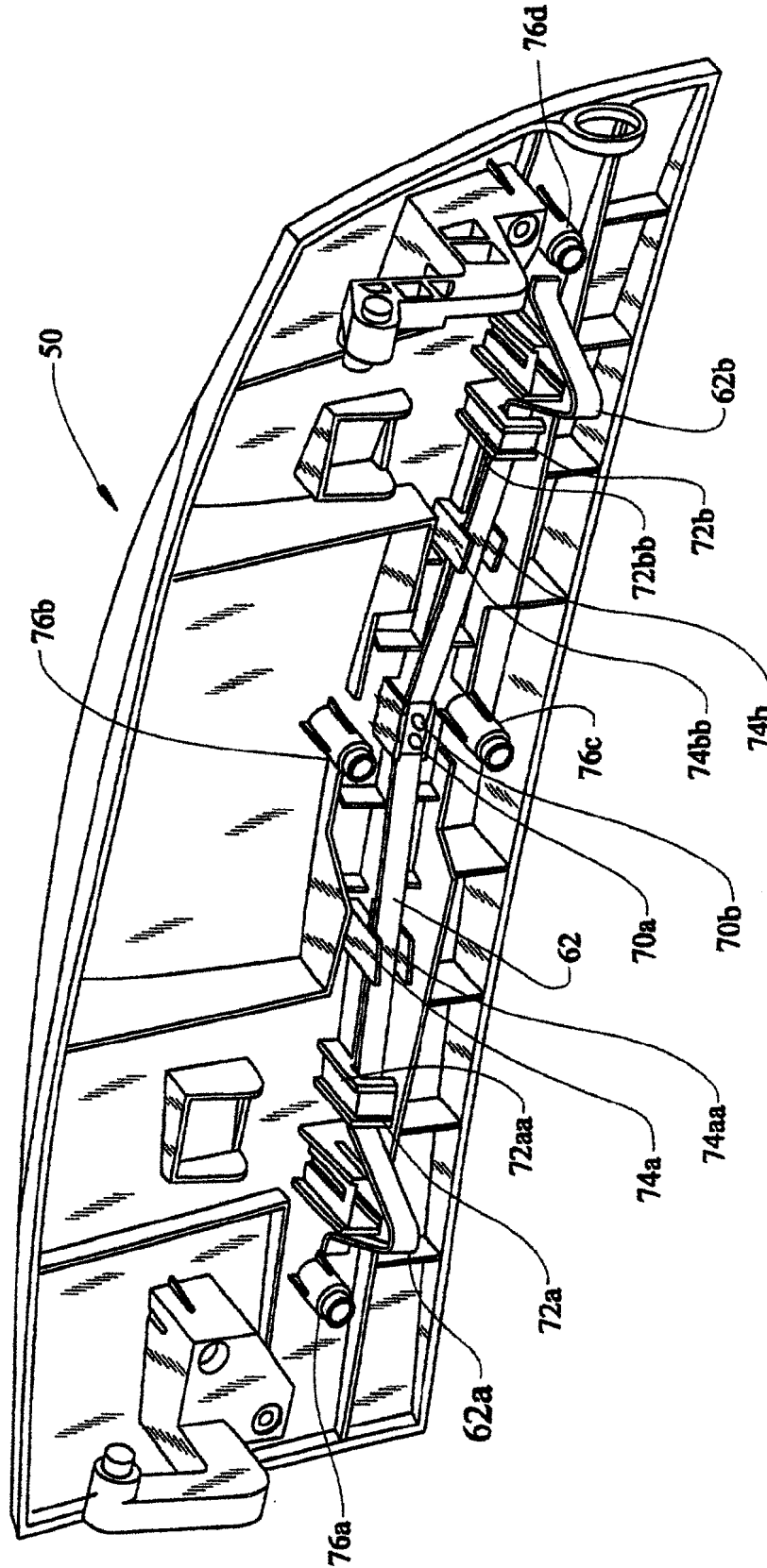
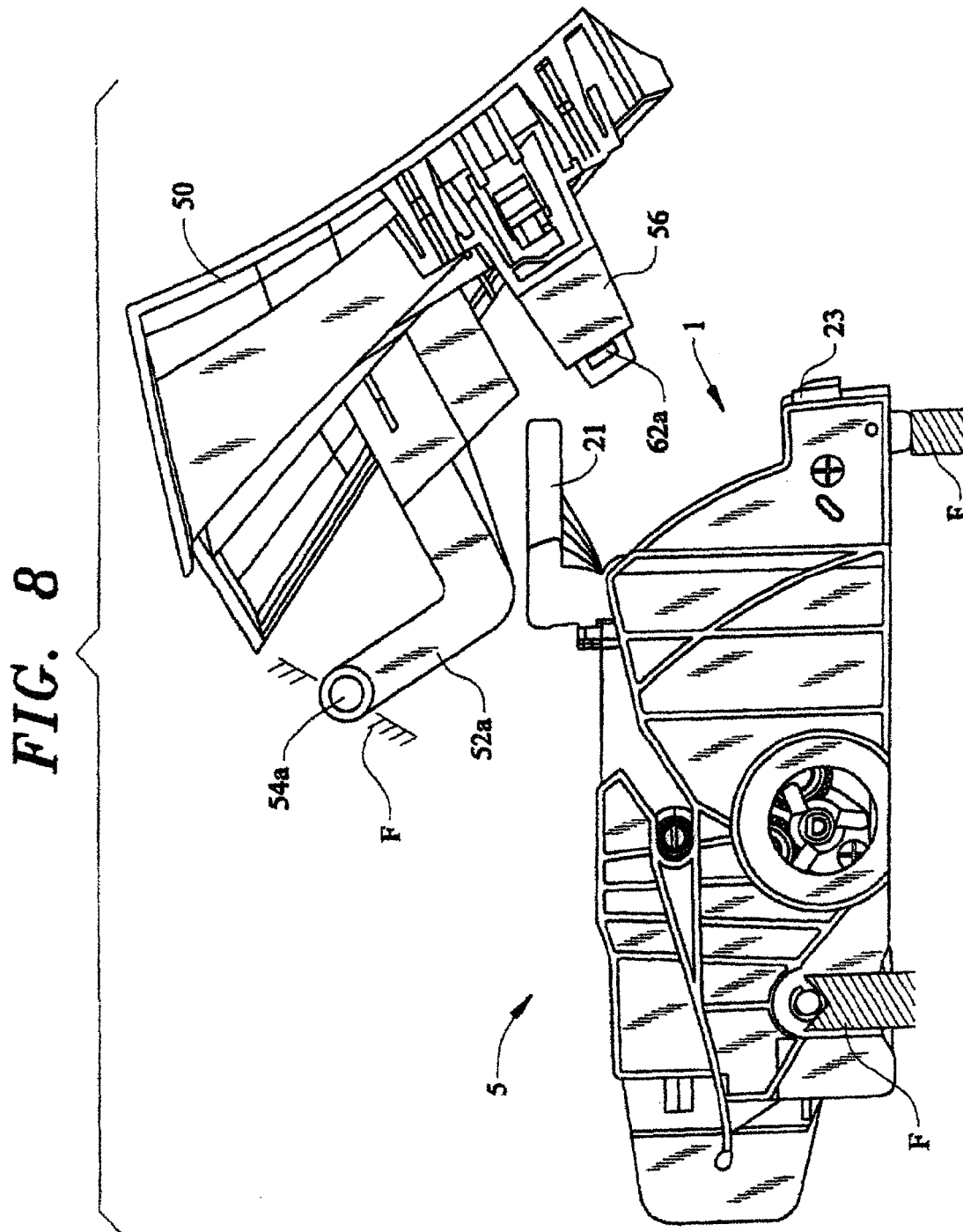


FIG. 7

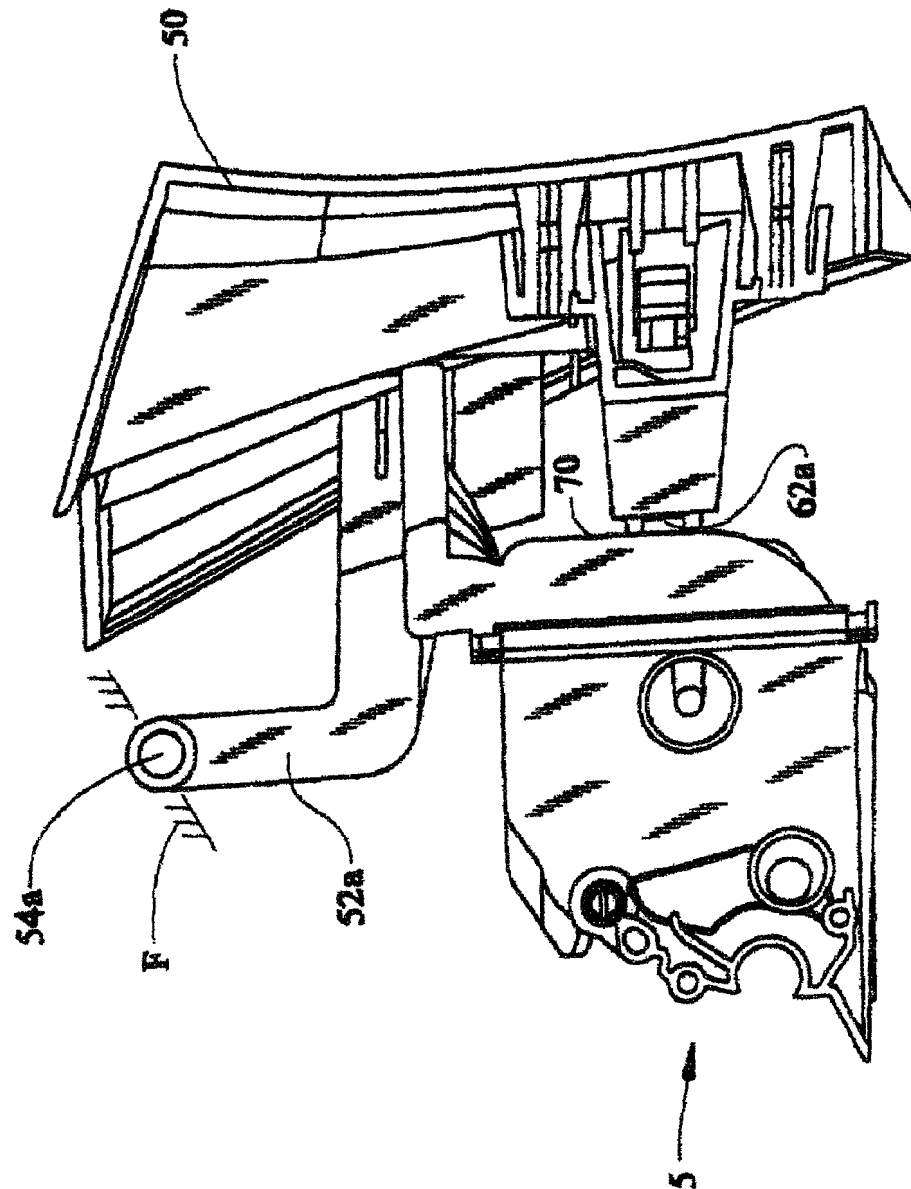






## A4460

FIG. 9



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**TWO PART CARTRIDGES WITH FORCE  
BIASING BY PRINTER****RELATED APPLICATIONS**

The present application is a continuation of application Ser. No. 11/057,550 filed on Feb. 14, 2005, which is a continuation of application Ser. No. 10/736,355 filed on Dec. 15, 2003, now U.S. Pat. No. 6,879,792, which is a continuation of application Ser. No. 10/195,270 filed on Jul. 15, 2002, now U.S. Pat. No. 6,678,489.

**TECHNICAL FIELD**

This invention relates to electrophotographic imaging and, more particularly, relates to separate replaceable cartridges for toner and photoconductor, which are pressed together for good operation when installed in the imaging device.

**BACKGROUND OF THE INVENTION**

Electrophotographic toner cartridges are often joined in two sections pivoted to one another so that a developer roller can be pressed against a photoconductor drum with controlled pressure. The controlled pressure is provided by permanently installed springs stretching between the two sections. The two sections are not normally separated, so such cartridges can be said to be one part cartridges.

Such one part cartridges have the advantage of having the spring force installed at the factory manufacturing the cartridge and having a relatively short duration during which the springs need provide the correct pressure, since the entire cartridge is refurbished (or discarded) after use of the original cartridge. Such one-piece cartridges have the disadvantage that the springs must be included on each cartridge. Also, for such one piece cartridges, replacement of the toner with a new section having the toner is not practical since the sections are not readily separated.

Two part cartridges are known in which a part having the toner is readily separated from a part having the photoconductor drum, since they are not pivoted to one another. To install such two part cartridges for imaging, they are manually brought together by the operator, and then the operator activates a latching mechanism, such as a resilient latch or a lever of some kind, to force the two parts together with the appropriate pressure for imaging.

A disadvantage of such known two part cartridges is that the forcing mechanism must be on one or both of the two parts and therefore adds to supplies costs, as both of the two parts are typically replaceable as they are worn (in the case of the photoconductor and other physical parts) or expended (in the case of the toner). Another disadvantage is that operator involvement requires training or some skill, and requires an overall design which permits the operator to reach the latching mechanism and activate it or deactivate it. A further disadvantage is that the force biasing elements require some space in the body of the imaging device.

**DISCLOSURE OF THE INVENTION**

This invention provides for two part cartridges which have no mechanism to latch the cartridges together. Biasing force during use is provided from the cover of the imaging device when closed. The two parts need only have conforming external configurations so that they fit together, and require no space in the middle of the printer for a force

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biasing element. No operator involvement in forcing the two parts together is required except for inserting the cartridges in the imaging device and closing the cover of the imaging device. Although the biasing by the cover may be by a spring or springs more costly than springs or other forcing mechanism which might be on the parts, over the life of the imaging device the overall costs typically will be less.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The details of this invention will be described in connection with the accompanying drawings, in which

FIG. 1 is a perspective view from the right of the two parts of the cartridge separated;

FIG. 2 is a side view from the left with covers removed showing selected parts of the two parts of the cartridge in contact when being forced together by the cover of the printer;

FIG. 3 is a side view from the right of the two parts of the cartridge forced together;

FIG. 4 is a side view from the left of the two parts of the cartridge separated;

FIG. 5 is a side view from the left of the two parts of the cartridge forced together;

FIG. 6 is a perspective view from the left showing the inside of the cover of the printer;

FIG. 7 is a perspective view of the cover like the view of FIG. 6 with a housing deleted to fully show the spring mounting;

FIG. 8 is a side view from the left sectioned in the middle of the cover showing the cover open and the cartridge parts installed in the printer; and

FIG. 9 is a side view as in FIG. 8 showing part 5 with the cover pivoted to its final position in which it is applying a force by contacting on the toner part of the cartridge.

**DESCRIPTION OF THE PREFERRED  
EMBODIMENTS**

Referring to FIG. 1, a replaceable cartridge part 1 containing a photoconductive drum 3 (shown in FIG. 2) is shown separated from a replaceable cartridge part 5 containing a developer roller 7 and toner (not shown). The right side of part 1 has an upper guide channel 9 ending in a flat section 11 having a rear wall 13. The right side of part 1 also has a lower guide channel 15. Planar member 16 is a guide for installation in a printer.

The right side of part 5 has an upper guide stud 17 and a lower guide stud 19. FIG. 3 shows the two parts 1 and 5 forced together in accordance with this invention. Guide stud 17 fits in channel 9 but does not reach wall 13. Similarly, guide stud 19 fits in channel 15. Channels 9 and 15 direct the guide studs 17 and 19 respectively to bring developer roller 7 in contact with photoconductor drum 3 (FIG. 2).

Part 5 has an upper handle 21, which can be readily grasped by an operator to pull part 5 away from part 1. Part 1 has a lower handle 23 which extends past part 5 when the two are combined (FIG. 2). Handle 21 and handle 23 can be grasped and pulled by an operator to pull out part 1 and part 5.

Since part 5 contains toner used for imaging, part 5 will be extracted and replaced with a replacement part 5 having toner more frequently than part 1 will be replaced. Part 1 will be extracted and replaced with a replacement part 1 when the photoconductor becomes deteriorated or when excess toner fills the compartment in part 1 for toner cleaned from the photoconductor 3 (such cleaning is standard).

Referring to FIG. 4, the two parts 1 and 5 are shown from the left side separated. Part 1 has a guide channel 30 ending in a flat section 32 having a rear wall 34. Part 5 has a guide stud 36. The cover of part 1 has an opening 38 to provide external access to driven coupling 40 when part 5 is pressed against part 1 (FIG. 5). Planar member 42 is a guide for installation in a printer, as is standard.

The action of the drive coupling and the gears shown will not be described in detail as they are essentially standard for imaging by driving known parts, not shown, including a toner adder roller and a toner mixing paddle, as well photoconductor drum 3 and the developer roller 7. Similarly, with reference to FIG. 2, spring 46 biasing a change roller 48 against photoconductor 3 is standard and will not be further discussed.

FIG. 5 shows parts 1 and 5 from the left forced together in accordance with this invention. Guide stud 36 fits in channel 30 but does not reach wall 34. Channel 30 directs stud 36 to bring developer roller 7 in contact with photoconductor drum 3 (FIG. 2). Driven coupler 40 is located in opening 38 (FIG. 4) for access by a printer drive coupler (not shown).

Guide studs 17, 19 and 36 are external caps of DELRIN 500 polyacetal, a hard plastic, mounted on shafts integral with the body of part 5. The body of part 5 is made of polystyrene. Openings 17a, 19a (FIG. 1) and 36a (FIG. 4) permit flexing of the shafts. The DELRIN polyacetal caps have a circumferential groove which meshes with small, radial tongues (not shown) extending into the grooves of the caps to thereby form studs 17, 19 and 36. The caps are free to rotate, but they may simply slide without loss of important function with respect to this invention. Alternative materials and construction of studs 17, 19 and 36 could be readily employed.

Referring to FIG. 6, the inside of printer cover 50 is shown, which may be made of a standard, strong plastic. Mounted on opposite sides of cover 50 are pivot arms 52a and 52b, having near their ends pivot studs 54a and 54b. Pivot studs 54a and 54b enter frame F (FIG. 8) of the printer (only frame of printer illustrated in this description) to define fixed pivot points of cover 50 relative to the frame F.

Mounted on the inside of cover 50 is one-piece housing 56, mounted to cover 50 by four screws, 58a-58d. Housing 56 has latching members 60a and 60b on opposite sides of cover 50. Primarily significant to this invention, housing 50 confines a leaf spring 62, having opposed bent ends 62a and 62b which extend past housing 56 at openings 56a and 56b on opposite sides of cover 50.

Housing 56 has integral, upward extending arms 57a-57d, which contact cover extensions 50a-50d. Screws 58a-58d are located in lateral, oval slots in housing 56. Integral with housing 56 on the left is a flat, pressing surface or "button" 64. When cover 50 is closed, latching members 60a and 60b are pushed leftward by arms 57a-57d acting on extensions 50a-50d. An operator pushing on button 64 overcomes this force and frees latches 60a and 60b to allow cover 50 to open.

FIG. 7 is the same view as FIG. 6 with housing 56 and its integral parts deleted so as to better show spring 62 and its mounting. In this embodiment, spring 62 is a single leaf spring held against cover 50 by two screws 70a, 70b located at the center of spring 62. Spring 62 is held against undue movement away from cover 50 by spaced ledge members 72a, 72b on cover 50. Spring 62 is confined from undue movement laterally by the extensions 72aa and 72bb holding ledge members 72a and 72b and by upper and lower spaced ledges 74a, 74aa and 74b and 74bb. Mounting posts 76a-76d receive screws 58a-58d (FIG. 6).

FIG. 8 shows cover 50 open and the full cartridge of parts 1 and 5 in its installed position on the printer, illustrated as frame elements F. The installed parts are held against further movement away from cover 50 by being blocked by frame F.

FIG. 9 omits cartridge part 1 to better illustrate cartridge part 5. Part 5 is also in the installed position as shown in FIG. 8. In this position part 1 has a substantially vertical front wall 70. Upon closing of cover 50, the ends 62a and 62b encounter front wall 70 of cartridge part 5 and press it against part 1. As discussed with respect to FIG. 8, the installed cartridge parts 1 and 5 are held against movement away from door 50 by frame members of the printer. Latch members 60a and 60b flex past ledges (not shown) in the frame F and then latch over the ledges,

#### VARIATIONS AND ALTERNATIVES

Although spaced spring contacts as in the foregoing embodiment tend to minimize variations between printers from differences within accepted tolerance, clearly a single leaf spring mounted in the center is an alternative. Of course, two spaced coil springs is an alternative. Other members can provide resilience, such as a urethane rubber pads. Instead of spaced contacts, a wide, resilient pad could provide the force biasing. In sum, this invention is not deemed limited by the details of the biasing member operating from the cover. The cover could provide a linkage to move a separated biasing member with movement of the cover, although this normally would be more expensive than simply mounting the biasing member on the cover.

A modification of the foregoing under consideration is to replace spring 62 by two, separate leaf springs, each originating near the middle of cover 50 and terminating as shown in the foregoing.

Although the cover in the foregoing embodiment opens from the bottom, a clear alternative would be to hinge the cover on the bottom so that it opens from the top.

Other variations and alternatives will be readily apparent or can be anticipated.

What is claimed is:

1. A toner container for use in combination with a photoconductive unit in an image forming apparatus, the toner container comprising:

a housing including first, second, and third sides, the first side extending between the second and third sides; a reservoir within the housing that is sized to contain toner;

a developer member rotatably mounted to the housing to receive the toner from the reservoir, the developer member positioned to extend outward from the first side of the housing;

first and second guide members each extending outward from the second side of the housing, the second side being adjacent to the first side; and

a third guide member extending outward from a third side of the housing, the third side being adjacent to the first side;

the reservoir being inlet-free and including an outlet, the developer member being positioned within the outlet.

2. The toner container of claim 1, wherein the second and third sides of the housing are substantially perpendicular to the developer member.

3. The toner container of claim 1, wherein the second and third sides are substantially parallel.

4. The toner container of claim 1, wherein the housing further includes a bottom side that attaches to the first,



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second, and third sides, wherein one of the first and second guide members and the third guide member are positioned farther from the bottom side than the developer member is positioned from the bottom side.

5 5. The toner container of claim 1, wherein the first and second guide members extend outward beyond the second side farther than the developer member.

6. The toner container of claim 5, wherein the first side is positioned at ends of the second and third sides.

7. A toner container for use in combination with a 10 photoconductive unit in an image forming apparatus, the toner container comprising:

a toner reservoir positioned within a housing;

a developer roller extending outward from a first side of the housing and being in communication with the toner 15 reservoir to receive toner, the developer roller being substantially cylindrical;

first and second elongated guide members each extending outward from a second side of the housing, the first and second guide members being aligned substantially parallel 20 with the developer roller; and

a third elongated guide member extending outward from a third side of the housing and being substantially parallel with the developer roller;

the reservoir being inlet-free and including an outlet, the 25 developer member being positioned within the outlet.

8. The toner container of claim 7, further comprising a handle extending outward from a fourth side of the housing, the handle being extending from a substantially opposite side of the housing from the developer roller.

9. The toner container of claim 7, further comprising a coupling extending outward from the third side of the housing to engage with the photoconductive unit.

10. The toner container of claim 7, wherein the first and third guide members are distanced a substantially equal 35 distance from the developer roller.

11. The toner container of claim 10, wherein the second guide member is positioned in closer proximity to a bottom of the housing than the first and third guide members are positioned from the bottom of the housing.

12. The toner container of claim 7, wherein the second and third sides of the housing are substantially perpendicular to the developer member.

13. The toner container of claim 7, wherein the first and second guide members extend outward beyond the second

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side farther than the developer member, and the third guide member extends outward beyond the third side farther than the developer member.

14. A toner container for use in combination with a photoconductive unit in an image forming apparatus, the toner container comprising:

a housing including a first side adjacent to second and third lateral sides;

a reservoir within the housing that is sized to contain toner;

a developer member rotatably mounted to the housing to receive the toner from the reservoir, the developer member positioned to extend outward from the first side of the housing;

first and second guide members each extending outward from the second side of the housing;

a coupling extending outward from the third side of the housing; and

a third guide member extending outward from the third side of the housing, the third guide member extending outward a greater distance than the coupling.

15. The toner container of claim 14, wherein the first, second, and third guide members each include an elongated shape that is each aligned substantially parallel with the developer member.

16. The toner container of claim 14, wherein the housing further includes a bottom, the coupling being positioned in closer proximity to the bottom than the third guide member is positioned from the bottom.

17. The toner container of claim 16, wherein the first and third guide members are each positioned a substantially equal distance from the bottom.

18. The toner container of claim 14, further comprising a plurality of gears extending outward from the third side of the housing.

19. The toner container of claim 14, further comprising a handle that extends outward from the housing, the handle being positioned on an opposite side of the housing from the developer member.

20. The toner container of claim 14, wherein the second guide member is positioned a greater distance from the developer member than the first and third guide members are positioned from the developer member.

\* \* \* \* \*

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Only the Westlaw citation is currently available.  
United States District Court, N.D. Illinois, Eastern  
Division.

Robert Bosch LLC, Plaintiff,  
v.  
Trico Products Corporation, and **Trico Products**,  
Defendants.  
Trico Products Corporation, Counter-Plaintiff,  
v.  
Robert Bosch LLC and Robert Bosch GmbH,  
Counter-Defendants.

No. 12 C 437 | Signed May 21, 2014

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**MEMORANDUM OPINION**

John F. Grady, United States District Judge

\*1 Before the court is defendant Trico Products Corporation's ("Trico") motion for summary judgment of noninfringement of U.S. Patent Nos. 6,553,607 (the "'607 patent'"), 6,530,111 (the "'111 patent'"), 6,944,905 (the "'905 patent'"), and with respect to Trico's "Duralast Flex Blade." For the reasons explained below, we deny Trico's motion.

**BACKGROUND**

Trico manufactures windshield wiper blades. (Trico's L.R. 56.1 Stmt. of Material Facts ("Trico's Stmt.") ¶ 1.) Plaintiff Robert Bosch LLC ("Bosch") manufactures

windshield-wiper systems and sells them to automobile manufacturers. (*Id.* at ¶ 2.) It also sells aftermarket replacement blades. (*Id.*) The '607 patent and the '111 patent each claim a "wiper apparatus" requiring, among other things, a "wiper arm" and a "wiper blade." (*Id.* at ¶ 22.) Bosch alleges that Trico's wiper blades infringe the '607 and '111 patents when combined with a pre-existing wiper arm. Trico argues that it is entitled to summary judgment on this claim under the doctrine of permissible repair.

Bosch also alleges that Trico's Duralast Flex Blade infringes the '905 patent, which claims a windshield wiper blade. Since 2002, Unipoint Electric Manufacturing Co., Ltd. ("Unipoint") has manufactured the Duralast Flex Blade for Trico. (*Id.* at ¶ 20.) Robert Bosch GmbH ("Bosch GmbH") acquired Unipoint in 2011.<sup>1</sup> In an email dated August 16, 2011, Unipoint assured Trico that their business relationship would "follow the ordinary business course" after Bosch GmbH acquired the company. (Trico's Stmt. ¶ 31.) The email attached a letter from Bosch GmbH addressed to Unipoint, asking Unipoint to reassure its customers that "Robert Bosch GmbH will fulfill all contracts and agreements which were concluded by [Unipoint] with their customers in a manner consistent with their past practices after the Closing." (*Id.*; see also Email Dated Aug. 16, 2011, attached as Ex. 9 to Bosch's Resp. to Trico's Stmt.) In March 2012, Trico asked Unipoint to confirm that "Trico has the right to use or sell those products manufactured for and sold to Trico by Unipoint." (Trico's Stmt. ¶ 32.) Unipoint responded as follows:

Unipoint became a member of the Bosch Group since Dec. 1, 2011. All products sold to Trico by Unipoint since takeover Dec. 1, 2011 under the existing supply agreements between the parties may be sold by Trico to third parties as stipulated in the respective supply agreements.

(*Id.* at ¶ 33; see also Letter Dated March 22, 2012, attached as Ex. D to Kubasiak Decl., attached as Ex. 2 to Trico's Stmt.) Trico argues that Unipoint's assurances, and its affiliation with Bosch, prohibit Bosch from pursuing any claim against Trico for sales of Unipoint-manufactured Duralast Flex Blades.

**DISCUSSION**



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**A. Legal Standard**

\*2 “The court shall grant summary judgment if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law.” [Fed.R.Civ.P. 56\(a\)](#). In considering such a motion, the court construes the evidence and all inferences that reasonably can be drawn therefrom in the light most favorable to the nonmoving party. *See Pitasi v. Gartner Group, Inc.*, 184 F.3d 709, 714 (7th Cir.1999). “The court need consider only the cited materials, but it may consider other materials in the record.” [Fed.R.Civ.P. 56\(c\)\(3\)](#). “Summary judgment should be denied if the dispute is ‘genuine’: ‘if the evidence is such that a reasonable jury could return a verdict for the nonmoving party.’ ” *Talanda v. KFC Nat’l Mgmt. Co.*, 140 F.3d 1090, 1095 (7th Cir.1998) (quoting *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248 (1986)). The court will enter summary judgment against a party who does not “come forward with evidence that would reasonably permit the finder of fact to find in [its] favor on a material question.” *McGrath v. Gillis*, 44 F.3d 567, 569 (7th Cir.1995).

**B. Permissible Repair**

The unrestricted sale of a patented product “exhausts” the patentee’s right to control the purchaser’s use of the product. *Jazz Photo Corp. v. International Trade Com’n*, 264 F.3d 1094, 1105 (Fed.Cir.2001). After the sale, the purchaser “has the rights of any owner of personal property, including the right to use it, repair it, modify it, discard it, or resell it, subject only to overriding conditions of the sale.” *Id.* at 1102. But the right to repair the purchased product does not include the right to “construct an essentially new article on the template of the original, for the right to make the article remains with the patentee.” *Id.* There is a “continuum” between permissible repair and impermissible reconstruction. *Id.*; *see also Aktiebolag v. E.J. Co.*, 121 F.3d 669, 674 (Fed.Cir.1997) (“[T]here is no bright-line test for determining whether reconstruction or repair has occurred.”). Relevant factors include: “the nature of the actions by the defendant, the nature of the device and how it is designed (namely, whether one of the components of the patented combination has a shorter useful life than the whole), whether a market has developed to manufacture or service the part at issue and objective evidence of the intent of the patentee.” *Aktiebolag*, 121 F.3d at 673. Besides these factors, the Federal Circuit requires the party asserting permissible repair to show that the repaired device was first sold in the United States. *See Jazz Photo*, 264 F.3d at 1105 (“United States patent rights are not exhausted by products of foreign provenance. To invoke the protection of the first sale doctrine, the authorized first sale must have occurred under the United States patent.”).

**1. Territoriality**

Trico argues that the Supreme Court eliminated the territoriality requirement in *Kirtsaeng v. John Wiley & Sons, Inc.*, 133 S.Ct. 1351 (2013). *Kirtsaeng* abolished the “first sale” rule as applied to claims for copyright infringement. *See id.* at 1371. The Federal Circuit may at some point reconsider *Jazz Photo* in light of the Supreme Court’s analysis in *Kirtsaeng*, but it has not done so yet. It appears that only one district court has addressed *Kirtsaeng*’s impact on *Jazz Photo*. *See Lexmark Intern., Inc. v. Ink Technologies Printer Supplies, LLC*, Case No. 1:10-cv-564, 2014 WL 1273665, \*2–7 (S.D. Ohio Mar. 27, 2014). The *Lexmark* court concluded after careful analysis that *Kirtsaeng* does not overrule *Jazz Photo*. *Id.* at \*2–7. Trico’s argument to the contrary is cursory. (*See* Trico Reply at 3.) We decline to hold that a first sale in the United States is no longer a requirement for patent exhaustion. Bosch contends that some of the relevant wiper apparatuses were first sold abroad, then imported into the United States. (*See* Bosch’s Stmt. of Add’l Facts 9[9] 48–50, 52–56. ) Trico concedes the point, at least at this stage of the case. (*See* Trico’s Resp. to Bosch’s Stmt. of Add’l Facts 9[9] 50, 56. ) But Bosch admits that it also sold some patented apparatuses within the United States. (*See* Bosch’s Stmt. of Add’l Facts 9[9] 42–44.) As to those devices, the doctrine of permissible repair may still apply.

**2. Whether Wiper–Blade Replacement Constitutes Permissible Repair**

\*3 We think it is clear that, in the abstract, vehicle owners who replace wiper blades with Trico’s products have permissibly repaired the purchased wiper “apparatus.” Bosch recommends that consumers replace wiper blades every six months. (*See* Trico Stmt. 9[ 39. ) There is no evidence in the record about the expected life of the entire wiper system, including the wiper arm. But the parties appear to agree – consistent with the experiences of anyone who has ever owned a car – that the “apparatus” is expected to outlast the blades. *See Aktiebolag*, 121 F.3d at 673 (the fact that the replaced component wears out sooner than the entire combination supports finding permissible repair). Both Trico and Bosch sell aftermarket replacement blades, which supports the conclusion that there is a well-developed market for replacement parts. *See id.* (an established market for replacement parts supports a finding of permissible repair). Finally, the act of replacing a wiper blade is analogous to the repair of other devices that Supreme Court and the Federal Circuit have held to be permissible. *See Wilson v. Simpson*, 50 U.S. 109, 1123

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(1850) (replacing the blades of a patented planing machine constituted permissible repair); *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 365 U.S. 336, 346 (1961) (replacing the worn fabric cover of a patented convertible top was permissible repair); *Kendall Co. v. Progressive Medical Technology, Inc.*, 85 F.3d 1570, 1574–75 (Fed.Cir.1996) (replacing the pressure sleeves in a patented medical device was permissible repair); *FMC Corp. v. Up-Right, Inc.*, 21 F.3d 1073, 1077–79 (Fed.Cir.1994) (replacing the worn “picking heads” of a harvester was permissible repair). Bosch argues that wiper-blade replacement constitutes reconstruction because of the alleged differences between parties’ products: if, as Trico argues, its wiper blades do not infringe Bosch’s patents, then they must be so different from the patented product that their use constitutes impermissible reconstruction. (See Bosch Resp. at 11.) In support of this argument, Bosch cites cases discussing the difference between repair and reconstruction, generally. (*Id.* at 12.) The Supreme Court and the Federal Circuit have refined the distinction between the two concepts in cases applying the doctrine to various devices. Those cases support finding permissible repair in this case. (See *supra*.) Conversely, Bosch has not cited any case in which a court has held that replacing a part analogous to the wiper blades in this case constituted impermissible reconstruction.

The more difficult question is whether Bosch’s wiper-blade patents (e.g., the ‘905 patent) render the permissible-repair doctrine inapplicable. The parties agree that the ‘111 and ‘607 patents are “combination” patents. A “combination patent covers only the totality of the elements in the claim and that no element, separately viewed, is within the grant.” *Aro*, 365 U.S. at 344. This is so even if a particular component is “essential” to the combination as a whole:

No element, **not itself separately patented**, that constitutes one of the elements of a combination patent is entitled to patent monopoly, however essential it may be to the patented combination and no matter how costly or difficult replacement may be.

*Id.* at 345 (emphasis added). Bosch argues that unlike the fabric covers in *Aro*, its wiper blades are patented, albeit by separate patents. So, according to Bosch, replacing the wiper blade with a Trico product infringes **both** the component patents **and** the combination patents. What little case law there is on this subject tends to support Bosch’s argument. In *Warner & Swasey Co. v. Held*, 256 F.Supp. 303, 311 (E.D.Wis.1966), the court reasoned that the existence of a separate patent on one component of the

patented combination negated the inference that “in selling the combination [the patentee] contemplates or intends licensing such purchaser to replace the patented part from any source other than himself.”<sup>22</sup> The court in *R2 Medical Systems, Inc. v. Katecho, Inc.*, 931 F.Supp. 1397 (N.D.Ill.1996) followed *Warner & Swasey* and elaborated on its reasoning:

Where the part is unpatented, the Supreme Court has emphasized that the critical question is whether the entire combination is exhausted.

But if the new part is protected under separate patent, the court does not inquire whether the entire combination is exhausted upon the replacement of the worn part. Replacement with the patented part does not infringe the combination patent because that separate patent ascribes the status of the combination to that part. The separate patent does not render the inventiveness of the component an “essential” element of the invention of the combination. *Aro I* clearly rejected this analysis. Rather, replacement infringes the combination patent because the purchaser engages in an unauthorized use of the combination by configuring it with an element that infringes another patent of the patent owner. Whether considered a form of unauthorized use or reconstruction, the purchaser has no license to maintain the “use of the whole” through elements that infringe the combination patent owner’s separate patent. Thus, in contrast to the repair and reconstruction inquiry, R2’s legal action under the system patents does not challenge the use of the electrode elements, “separately viewed.” It challenges a particular use of the combination with the infringing electrodes.

\*4 *Id.* at 1445–46 (footnote omitted).

Trico argues that this reasoning is inconsistent with the Supreme Court’s decision in *Quanta Computer, Inc. v. LG Electronics, Inc.*, 553 U.S. 617 (2008). *Quanta* held that a patentee exhausts its patent rights by selling a product that substantially embodies, but only partially practices, the patent. *Id.* at 630–35. Trico relies in particular on the following passage from the Court’s opinion:

With regard to LGE’s argument that exhaustion does not apply across patents, we agree on the general principle: The sale of a device that practices patent A does not, by virtue of practicing patent A, exhaust patent B. But if the device practices patent A while substantially embodying patent B, its relationship to patent A does not

prevent exhaustion of patent B. For example, if the Univis lens blanks had been composed of shatter-resistant glass under patent A, the blanks would nonetheless have substantially embodied, and therefore exhausted, patent B for the finished lenses. This case is no different. While each Intel microprocessor and chipset practices thousands of individual patents, including some LGE patents not at issue in this case, the exhaustion analysis is not altered by the fact that more than one patent is practiced by the same product. The relevant consideration is whether the Intel Products that partially practice a patent—by, for example, embodying its essential features—exhaust *that* patent.

*Id.* at 634–35 (emphasis in original). Trico construes this passage to require patent-by-patent analysis in cases involving exhaustion. But the issue in *Quanta* was substantially different than the issue here. The Court did not hold, or even suggest, that replacing a portion of a patented combination with a separately patented component only infringes the component patent.

Notwithstanding the lack of contrary authority, we have reservations about the reasoning in *Warner & Swasey* and *R2 Medical Systems*. Both courts emphasized the patentee's expectations and intentions. See *Warner & Swasey*, 256 F.Supp. at 311 (“The patentee, therefore, must have contemplated when he sold the combination that unless he extended to the purchaser a license to replace such parts from any available source, such combination would be of little use to the purchaser.”); see also *R2 Medical Systems*, 931 F.Supp. at 1446 (“It is because the patent owner's common ownership of the component patent negates the presumption that his sale of the patented combination also includes a license to preserve the entire combination through the use of the infringing device as an element of the patented combination.”). But as the Supreme Court explained in *Aro*, “the claims made in the patent are the sole measure of the grant.” *Aro*, 365 U.S. at 339. If the '111 and '607 patents do not claim wiper blades, how can an individual who replaces the wiper blade infringe those patents? Also, what if the combination patent predates the component patent? Does the component patent retroactively expand the scope of the combination patent to cover the previously unpatented component? We are not prepared at this time to reject *Warner & Swasey* and *R2 Medical*. But we have sufficient

doubts about whether they were correctly decided to withhold ruling pending a more developed record.

### C. Whether the Unipoint Acquisition Bars Bosch's Claim That Trico's Duralast Flex Blade Infringes its Patents

\*5 Trico makes essentially two arguments in support of its claim that Bosch cannot sue it for selling Unipoint-manufactured blades. First, it argues that Unipoint—as a member of the “Bosch Group”—promised that it would “fulfill all contracts and agreements which were concluded by [ Unipoint] with their customers in a manner consistent with their past practices after the closing.” (Trico Stmt. ¶ 31.) Bosch has clarified, consistent with this commitment, that it is not pursuing damages for post-closing sales by Trico. (See Bosch Resp. at 13.) The question is whether Bosch agreed not to pursue claims alleging pre-closing infringement. When Trico asked Unipoint to clarify Bosch GmbH's commitment, it stated only that Trico was authorized to resell Unipoint-manufactured blades purchased “since” December 1, 2011. (See Letter Dated March 22, 2012, attached as Ex. D to Kubasiak Decl.) So, as far as the record reveals, neither Unipoint nor Bosch/Bosch GmbH ever stated that it would not pursue infringement claims for sales pre-dating the closing.

Trico also argues that Bosch: (1) stepped into Unipoint's shoes after the closing, thereby barring any infringement claim that Unipoint could not have pursued in its own right; and (2) would be unjustly enriched if it was permitted to pursue claims for infringement while retaining the benefits of Unipoint's pre-closing sales to Trico. With respect to the first point, it appears that Bosch and Unipoint remain distinct corporate entities. Without some authority to the contrary – and Trico has not cited any – we will not treat Bosch and Unipoint as if they were the same company. With respect to the second point, we are not persuaded by Trico's analogy to *PSN Illinois, LLC v. Abbott Laboratories*, No. 09 C 5879, 2011 WL 4442825 (N.D.Ill. Sept. 20, 2011). In that case, PSN claimed that certain third parties had infringed its patented biotechnology. *Id.* at \*2. It settled those claims and granted the third parties licenses to use PSN's patents in the future, and released them from liability for past infringement. *Id.* at \*7–10. The third parties then sold the patented cell lines to the defendants. *Id.* at \*1–2. The PSN court held that PSN had exhausted its patent rights in the cell lines when it granted licenses to the third parties. *Id.* at \*6–7, \*9–10. So, it could not pursue infringement claims against downstream purchasers like the defendants. *Id.* PSN may be analogous to our case, depending upon the terms of Bosch GmbH's acquisition of Unipoint. But Trico has not

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cited or discussed those terms. Instead, it makes a more abstract point: Bosch GmbH – and Bosch, as its wholly-owned subsidiary – acquired the benefit of Unipoint’s prior sales to Trico when it acquired Unipoint. But it has not cited any case law supporting that theory, nor has it developed its argument that Bosch benefitted from Unipoint’s sales to Trico. On this record, we decline to rule that the Unipoint acquisition bars Bosch’s claim that Trico’s Duralast Flex Blade infringes its patents.

**CONCLUSION**

Trico’s motion for summary judgment [ 104] is denied.

## Footnotes

- <sup>1</sup> Bosch is a wholly-owned subsidiary of Bosch GmbH. (See Bosch GmbH Answer to Fourth Am. Counterclaims ¶ 12.) The parties disagree about the exact date when Bosch GmbH completed the acquisition. (See Bosch’s Resp. to Trico’s Stmt. ¶ 30.) But that dispute is irrelevant for the present motion.
- <sup>2</sup> The Fifth Circuit Court of Appeals cited *Warner & Swasey* with approval in *Hensley Equipment Co. v. Esco Corp.*, 383 F.2d 252, 260 (5th Cir.1967). But unlike this case, *Hensley* appears to have involved multiple claims within a single patent. See *id.* at 259–60. If the ‘111 and ‘607 patents claimed wiper blades and Trico’s products infringed those claims, then the doctrine of permissible repair would not excuse that infringement. But the question here is whether infringing a *separate* component patent also infringes the combination patent.

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United States District Court, N.D. California.

San Francisco Division

**San Disk Corporation**, Plaintiff,

v.

**Round Rock Research LLC**, Defendant.

No. C 11–5243 RS | Signed June 13, 2014

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**ORDER GRANTING IN PART AND DENYING IN PART MOTION FOR SUMMARY JUDGMENT RE PATENT EXHAUSTION**

**RICHARD SEEBORG**, UNITED STATES DISTRICT JUDGE

**I. INTRODUCTION**

\*1 Plaintiff SanDisk Corporation brought this action seeking declaratory relief that its products do not infringe certain patents held by defendant Round Rock Research LLC, and/or that the patents are invalid. The parties have now each brought motions seeking partial summary judgment regarding particular issues. As to three of the four patents remaining in suit, a threshold issue is whether the doctrine of patent exhaustion applies to bar Round Rock from pursuing its infringement claims against SanDisk.

There is no material factual dispute that the infringement claims arise at least in part from SanDisk's use of semiconductor memory devices it purchased from Toshiba entities that were licensed by Round Rock's predecessor to make, use, and sell the inventions of the patents on a world-wide basis. The primary legal question is whether, under the circumstances here, the fact that the sales from Toshiba to SanDisk occurred overseas precludes application of the patent exhaustion doctrine. Although the law is not fully settled, for the reasons explained below, SanDisk's motion seeking a determination that patent exhaustion bars the infringement claims arising from the Toshiba memory will be granted, with respect to [U.S. Patent No. 6,845,053](#) and [U.S. Patent No. 6,570,791](#). The motion will be denied in part with respect to [U.S. Patent No. 5,682,345](#) because SanDisk has not shown that the infringement claims under that patent are limited to the Toshiba memory.

**II. BACKGROUND**

Round Rock describes itself as a technology research and licensing company that holds thousands of patents and pending patent applications. Round Rock is what is commonly described as a "non-practicing entity"—that is, it does not manufacture or market products utilizing its patented inventions, but instead seeks licensing agreements from parties who do make and sell such products, or pursues litigation against them when it deems it necessary to do so. Round Rock acquired its patent portfolio from Micron Technology. The claimed inventions relate to a variety of products and technologies, such as televisions, cell phones, computers, cameras, processors, and memory products, among other things. SanDisk, in turn, designs, manufactures, and sells a wide variety of flash memory devices.

During the course of this litigation, the scope of the parties' disputes have narrowed. At this juncture, four patents held by Round Rock remain in issue. The '[053 patent](#)' relates generally to flash memory devices that allow a "mode" to be selected, for purposes of adjusting the tradeoff between performance speed and power consumption. The '[345 patent](#)' claims a device—a non-volatile data storage unit—and a method for controlling its operation. The '[791 patent](#)' relates to flash memory designed to be compatible with so called "double data rate" dynamic random access memory chips ("DDR DRAM"). Finally, [U.S. Patent No. 6,383,839](#) relates to mounting semiconductor devices on circuit boards perpendicularly to the surface of the boards. Of these four patents, only the '[839](#)' is not implicated by the

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patent exhaustion issue.

\*2 As to the products accused of infringing the other three patents, SanDisk bought the flash memory chips incorporated in those accused products from entities in the Toshiba corporate family. There is no dispute that before the patents were transferred to Round Rock, Micron entered into a written license agreement with Toshiba, granting Toshiba a “nonexclusive, non-transferable, royalty-free, world-wide license, without the right to sublicense third parties, to make, have made, use, sell, offer for sale, import or otherwise dispose of licensed products and to use any methods covered by Micron patents....” SanDisk contends that, as a result, the ‘053, ‘345, and ‘791 patents are exhausted, and do not support an infringement claim based on the memory chips it obtained from Toshiba. It is undisputed that the sales between Toshiba and SanDisk took place in Japan. Round Rock contends that exhaustion of United States patent rights simply does not arise from sales made outside the territorial jurisdiction of this country.

### III. LEGAL STANDARD

Summary judgment is proper “if the pleadings and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law.” Fed.R.Civ.P. 56(c). The purpose of summary judgment “is to isolate and dispose of factually unsupported claims or defenses.” *Celotex v. Catrett*, 477 U.S. 317, 323–24 (1986). The moving party “always bears the initial responsibility of informing the district court of the basis for its motion, and identifying those portions of the pleadings and admissions on file, together with the affidavits, if any, which it believes demonstrate the absence of a genuine issue of material fact.” *Id.* at 323 (citations and internal quotation marks omitted). If it meets this burden, the moving party is then entitled to judgment as a matter of law when the non-moving party fails to make a sufficient showing on an essential element of the case with respect to which it bears the burden of proof at trial. *Id.* at 322–23.

The non-moving party “must set forth specific facts showing that there is a genuine issue for trial.” Fed.R.Civ.P. 56(e). The non-moving party cannot defeat the moving party’s properly supported motion for summary judgment simply by alleging some factual dispute between the parties. To preclude the entry of summary judgment, the non-moving party must bring forth material facts, *i.e.*, “facts that might affect the outcome of

the suit under the governing law.... Factual disputes that are irrelevant or unnecessary will not be counted.” *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 247–48 (1986). The opposing party “must do more than simply show that there is some metaphysical doubt as to the material facts.” *Matsushita Elec. Indus. Co. v. Zenith Radio*, 475 U.S. 574, 588 (1986).

The court must draw all reasonable inferences in favor of the non-moving party, including questions of credibility and of the weight to be accorded particular evidence. *Masson v. New Yorker Magazine, Inc.*, 501 U.S. 496 (1991) (citing *Anderson*, 477 U.S. at 255); *Matsushita*, 475 U.S. at 588 (1986). It is the court’s responsibility “to determine whether the ‘specific facts’ set forth by the nonmoving party, coupled with undisputed background or contextual facts, are such that a rational or reasonable jury might return a verdict in its favor based on that evidence.” *T.W. Elec. Service v. Pacific Elec. Contractors*, 809 F.2d 626, 631 (9th Cir.1987). “[S]ummary judgment will not lie if the dispute about a material fact is ‘genuine,’ that is, if the evidence is such that a reasonable jury could return a verdict for the nonmoving party.” *Anderson*, 477 U.S. at 248. However, “[w]here the record taken as a whole could not lead a rational trier of fact to find for the non-moving party, there is no ‘genuine issue for trial.’ ” *Matsushita*, 475 U.S. at 587.

### IV. DISCUSSION

#### A. Applicability of patent exhaustion to overseas sales

\*3 Under 35 U.S.C. § 271, a defendant can only be liable for infringement if the allegedly infringing acts are carried out “without authority.” 35 U.S.C. §§ 271(a), (f), (g). “The longstanding doctrine of patent exhaustion provides that the initial authorized sale of a patented item terminates all patent rights to that item.” *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 625 (2008). The exhaustion doctrine prohibits patent holders from selling a patented article and then “invoking patent law to control postsale use of the article.” *Id.* at 638. The underlying rationale is that an unconditional sale of a patented device generally exhausts the patentee’s right to control the purchaser’s use of that item thereafter because the patentee has bargained for and received the full value of the goods. *Princo Corp. v. ITC*, 616 F.3d 1318, 1328 (Fed.Cir.2010) (en banc); see also, *U.S. v. Masonite Corp.*, 316 U.S. 265, 278 (1942) (“The test has been whether or not ... it may fairly be said that the patentee has received his reward for the use of the article.”). Exhaustion, however, “is triggered only by a sale authorized by the patent holder.” *Quanta*, 553 U.S. at 636.



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To argue that patent exhaustion does not apply here, Round Rock relies on the *Jazz Photo* line of cases<sup>1</sup> and *Ninestar Tech. Co. v. ITC*, 667 F.3d 1373 (Fed.Cir.2012). Each of these cases refused to apply patent exhaustion where the products in issue were first sold outside the United States. See, e.g., *Jazz Photo Corp. v. ITC*, 264 F.3d at 1105 (“United States patent rights are not exhausted by products of foreign provenance. To invoke the protection of the first sale doctrine, the authorized first sale must have occurred under the United States patent.”).

SanDisk, in turn, points to *Quanta*, in which the Supreme Court expressly cautioned against “the danger of allowing ... an end-run around exhaustion.” 553 U.S. at 630. Although the Court was addressing whether exhaustion applies to method claims, this District has previously observed that exempting overseas sales from the doctrine would constitute a similarly unjustifiable “end run.” *LG Electronics, Inc. v. Hitachi Ltd.*, 655 F.Supp.2d 1036, 1044–45. (N.D.Cal.2009).<sup>2</sup> Where, as here and as in *LG Electronics*, the patentee has negotiated and obtained consideration for granting an express world-wide license to “make, have made, use, sell, offer for sale, import or otherwise dispose of” products embodying the inventions, permitting the patentee to pursue infringement claims against “any downstream purchasers” would, in effect, allow the kind of double recovery the exhaustion doctrine ordinarily forecloses.

As observed in *Multimedia Patent Trust v. Apple, Inc.* 2012 WL 6863471 (S.D.Cal.2012) (“MPT”) the fact that the products were sold under the authority of a world-wide license agreement renders the *Jazz Photo* and *Ninestar* decisions distinguishable. See 2012 WL 6863471 at \*5 (“those cases only involved foreign sales made directly by the patentee and did not involve sales made pursuant to a unconditional worldwide license.”) The distinction is significant because the gravamen of the *Jazz Photo* line is that “a lawful foreign purchase does not obviate the need for license from the United States patentee before importation into and sale in the United States.” *Jazz Photo*, 264 F.3d at 1105. Thus, while the mere purchase of an item overseas that embodies a U.S. patent may not give the purchaser a right to import it into the United States, here Toshiba had such a right under the parties’ negotiated license agreement. Round Rock does not suggest that if Toshiba itself had shipped the products to this country prior to resale, there still would have been a viable infringement claim against Toshiba or any of its customers.

\*4 Round Rock (through its predecessor Micron) in effect had thereby already exercised its rights under U.S. Patent law by granting a license to Toshiba, for consideration, to

import patented technology into the United States, if it so chose (among the other rights conferred by the world-wide license). In contrast, the patentees in the *Jazz Photo* line of cases and *Ninestar* merely sold products in overseas retail markets, without expressly granting rights to import those items into this country.<sup>3</sup> As such import rights were not part of the sales, it could reasonably be said that the patentee had received no consideration “under” any U.S. Patent, and therefore that no exhaustion arose. Allowing the patentees to pursue infringement claims based on the subsequent importation of the products into this country did not represent a second attempt to collect for the same right.

Here, in contrast, Toshiba already gave consideration for the right to import devices embodying the patented inventions. That title to the chips passed before the shipping to this country took place is too thin a reed on which to permit the patentee an “end run” around the principle that it may only recover once. The *Jazz Photo* line of cases and *Ninestar* do not address these circumstances, and therefore are not governing, as recognized in *MPT*. See 2012 WL 6863471 at \*5; see also, *Tessera, Inc. v. ITC*, 646 F.3d 1357, 1369–70 (Fed.Cir.2011) (applying, without discussion, exhaustion doctrine in context of chips sold by foreign licensee and thereafter imported). In urging that exhaustion applies, SanDisk also places heavy emphasis on *Kirtsaeng v. John Wiley & Sons, Inc.*, 133 S.Ct. 1351 (2013), which held that the “first sale” doctrine in copyright law applies without territorial limitation.<sup>4</sup> Because *Kirtsaeng* analyzed and applied provisions of the Copyright Act, it is not directly controlling in the patent context. Nevertheless, *Kirtsaeng* provides at least some additional support for the notion that it would be inconsistent with the theoretical underpinnings of the exhaustion doctrine to apply a territorial limitation. In construing the present statutory language, *Kirtsaeng* observed that the common law first sale doctrine in copyright, “makes no geographical distinctions.” 133 S.Ct. at 1363. The Court concluded that the Copyright Act did not change the common law rule. *Id.* As the Patent Act is silent on the point, it also has not altered the common law. Thus, unless there is a basis to conclude that the common law approach should differ between patent and copyright, *Kirtsaeng* implicitly suggests the result reached here is appropriate.<sup>5</sup>

**B. Identity of Licensees**

Round Rock contends that even assuming exhaustion applies where a product is sold under the auspices of a world-wide license, there is still a question as to whether the particular Toshiba entities that sold the chips in issue were licensees under the Micron–Toshiba agreement.

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Round-Rock's sole argument is that while the language of the agreement undeniably encompasses "subsidiaries," it uses the present tense in the definition; e.g. "a legal entity of which a PARTY hereto owns or controls directly or indirectly more than fifty percent (50%) of the shares...." As the particular subsidiaries that made the sale came into legal existence after the effective date of the agreement, Round Rock argues they are outside its scope. Round Rock, however, has offered no legal authority or factual basis, however, to support such a restrictive and counter-intuitive reading of the contract language. It is undisputed that the sales were made by entities that fell within the language of the definition at the time of the sales. Reading the present tense language as effectively imposing a past tense requirement—i.e. that the entities were owned or controlled by Toshiba by the time the contract first became effective—is unwarranted.

### C. Scope of the exhaustion

\*5 Finally, Round Rock argues that even assuming patent exhaustion applies with respect to the memory chips SanDisk acquired from Toshiba, the doctrine cannot insulate SanDisk from liability for infringement claims based on its own *controllers*, rather than the Toshiba memory. Round Rock's argument fails as to both the '053 and the '791 patents.

As to those two patents, Round Rock relies on its assertion that "key" or "core" elements are performed by the controller chips, which are "custom-designed" by SanDisk. Under *Quanta*, a product substantially embodies the patent [where] the only step necessary to practice the patent is the application of common processes or the addition of standard parts." 553 U.S. at 634. While SanDisk may "custom design" these particular controllers, the patent claims merely recite a "processor," with no indication that any of the inventive aspects of the claims depend on the specifics of the processor, and there is no indication SanDisk's "custom design" transforms its controllers into something meaningfully distinguishable from "the application of common processes or the addition

of standard parts."

Moreover, Round Rock's own infringement contentions and its expert's opinions reflect that the memory chips fully or substantially embody the patent claims in suit, with respect to the '053 and the '791 patents. As such, it cannot now show that the claims depend on the controllers. See *LG Electronics, supra*, 655 F.Supp.2d at 1044 ("This establishes that, according to LGE's own theory of infringement, the parts substantially embody the patents, and LGE cannot claim otherwise.") Accordingly, the doctrine of patent exhaustion bars Round Rock's claims for infringement of the '053 and the '791 patents.

The '345 patent presents a different situation. While SanDisk has presented some arguments that the asserted claims are substantially embodied by the Toshiba chips, it has not met its burden to establish that claims related to the functionality of the controllers are barred with respect to this patent. Indeed, its moving papers merely incorporate by reference the arguments it previously made in opposition to Round Rock's motion seeking summary judgment that the exhaustion defense fails as a matter of law. As those arguments were directed to showing that "a trier of fact could easily conclude" the Toshiba chips gave rise to exhaustion, they fall short of establishing a right to summary judgment in SanDisk's favor.<sup>6</sup>

## V. CONCLUSION

SanDisk's motion for summary judgment as to the applicability of patent exhaustion is granted with respect to the '053 and the '791 patents, and denied as to the '345 patent. Round Rock's counter motion on the subject is denied. Further orders will issue on the motions that remain pending.

IT IS SO ORDERED.

### Footnotes

<sup>1</sup> *Jazz Photo Corp. v. ITC*, 264 F.3d 1094 (Fed.Cir.2001), *Fuji Photo Film Co., Ltd. v. Benun*, 463 F.3d 1252 (Fed.Cir.2006), and *Fujifilm Corp. v. Benun*, 605 F.3d 1366 (Fed.Cir.2010).

<sup>2</sup> The *LG Electronics* decision concluded that the first two *Jazz Photo* cases were simply no longer good law in light of *Quanta*. 655 F.Supp.2d at 1046. This Court is not free to reach the same conclusion now, because in the interim the Federal Circuit held in *Benun* and *Ninestar* that *Quanta* did not eliminate the territoriality issue. See *Benun*, 605 F.3d at 1371; *Ninestar*, 667 F.3d at 1378. Nevertheless, for reasons discussed below, the *Jazz Photo* line is distinguishable.

<sup>3</sup> A district court opinion in *Fuji Photo Film Co. v. Jazz Photo Corp.*, 249 F.Supp.2d 434 (D.N.J.2003) indicated that at least in that instance some of the products had been sold by licensees with a right to sell in the United States, and that such a fact did not alter its

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analysis. None of the circuit court opinions, however, expressly discussed the point.

- 4 First sale doctrine in copyright is conceptually analogous to patent exhaustion. See *Kirtsaeng*, 133 S.Ct. at 1355 (“In copyright jargon, the ‘first sale’ has ‘exhausted’ the copyright owner’s § 106(3) exclusive distribution right.”).
- 5 It plainly is SanDisk’s belief that the *Jazz Photo* line of cases was at least impliedly superseded by *Quanta* and *Kirtsaeng*, if not wrongly decided from the outset. Because *Ninestar* expressly held that the rule survived *Quanta*, and because *Kirtsaeng* construed the Copyright Act, not patent law, any such argument must be presented at the appellate level, not here.
- 6 On reply, SanDisk contends Round Rock’s present position is inconsistent with that taken in certain other litigation. SanDisk’s passing mention of that alleged inconsistency is insufficient to establish an estoppel or that Round Rock has made a binding admission.

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**United States Court of Appeals  
for the Federal Circuit**

*Lexmark International, Inc. v. Ink Technologies Printer*, 2014-1617, -1619

**CERTIFICATE OF SERVICE**

I, John C. Kruesi, Jr., being duly sworn according to law and being over the age of 18, upon my oath depose and say that:

Counsel Press was retained by THE ECLIPSE GROUP LLP, Attorneys for Appellant to print this document. I am an employee of Counsel Press.

On **December 30, 2014**, counsel has authorized me to electronically file the foregoing corrected **Joint Appendix (Confidential and Non-Confidential Versions)** with the Clerk of Court using the CM/ECF System, which will serve via e-mail notice of such filing to all counsel registered as CM/ECF users, including any of the following:

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The Confidential Joint Appendix will also be emailed and mailed to the above principal counsel on the same date as above.

Upon acceptance by the Court of the e-filed document, six paper copies of the Confidential Joint Appendix will be filed with the Court within the time provided in the Court's rules..

The Joint Appenix was originally filed and served on December 23, 2014.

December 30, 2014

/s/John C. Kruesi Jr.  
Counsel Press